The role of air transportation in regional development

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Joint Universities Program Meeting

October 10th , 2001

Why is air transportation important?

- **Fundamental hypothesis:**

appropriate use of air transportation is a necessary condition for significant economic and social development.

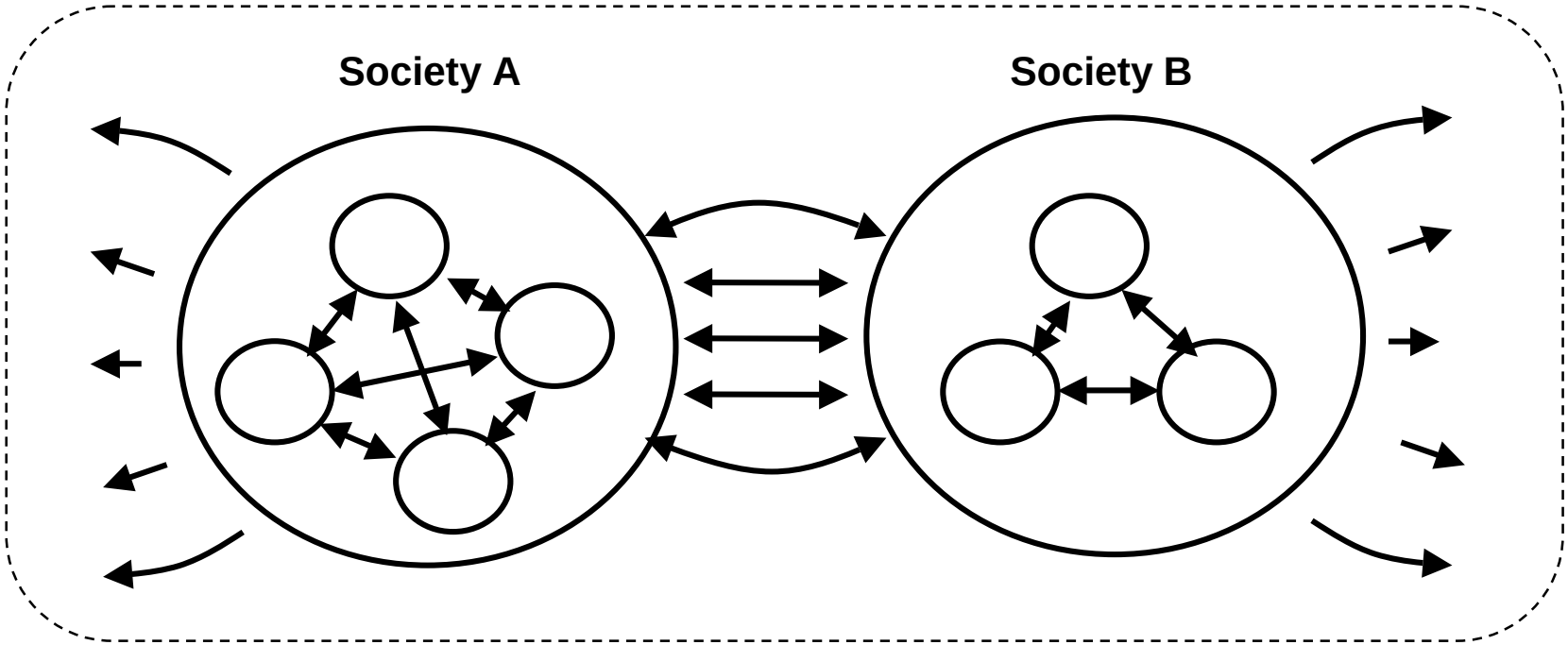
High-level objectives

- **Identify the impact (positive and negative) of air transportation transportation on the economy, society and environment of nations and regions**
- **Understand the mechanisms/important factors of these processes**
- **Provide enough understanding to support policymaking that takes advantage of those mechanisms and contribute to the economic and social development of nations and regions**

In this presentation . . .

- **Identify the impact of air transportation :**
  - Worldwide perspective:
    - Major trends in air transportation
    - Social and economic relationships
  - Local perspective:
    - Highlight interconnections of air transportation and social and economic development
    - Mostly qualitative because of data availability
- **Understand the mechanisms/important factors**
  - Not yet, need to do more research . . .
- **Help policymakers:**
  - (see above)

Context of air transportation



Societies interact:

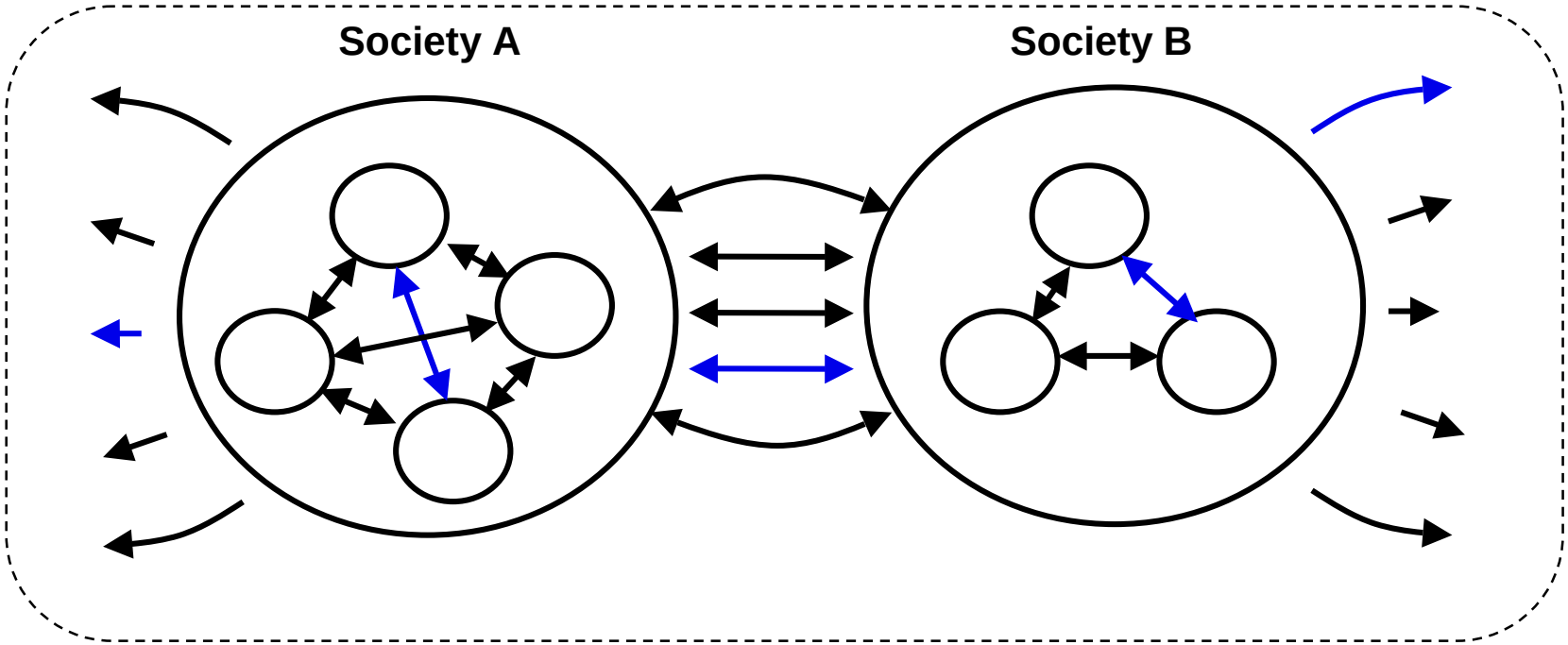
- -Internally
- -Bilaterally
- -Multilaterally

Relationships are:

- -Political
- -Economic
- -Social, etc

. . . within a given environmental & regulatory context

Context of air transportation



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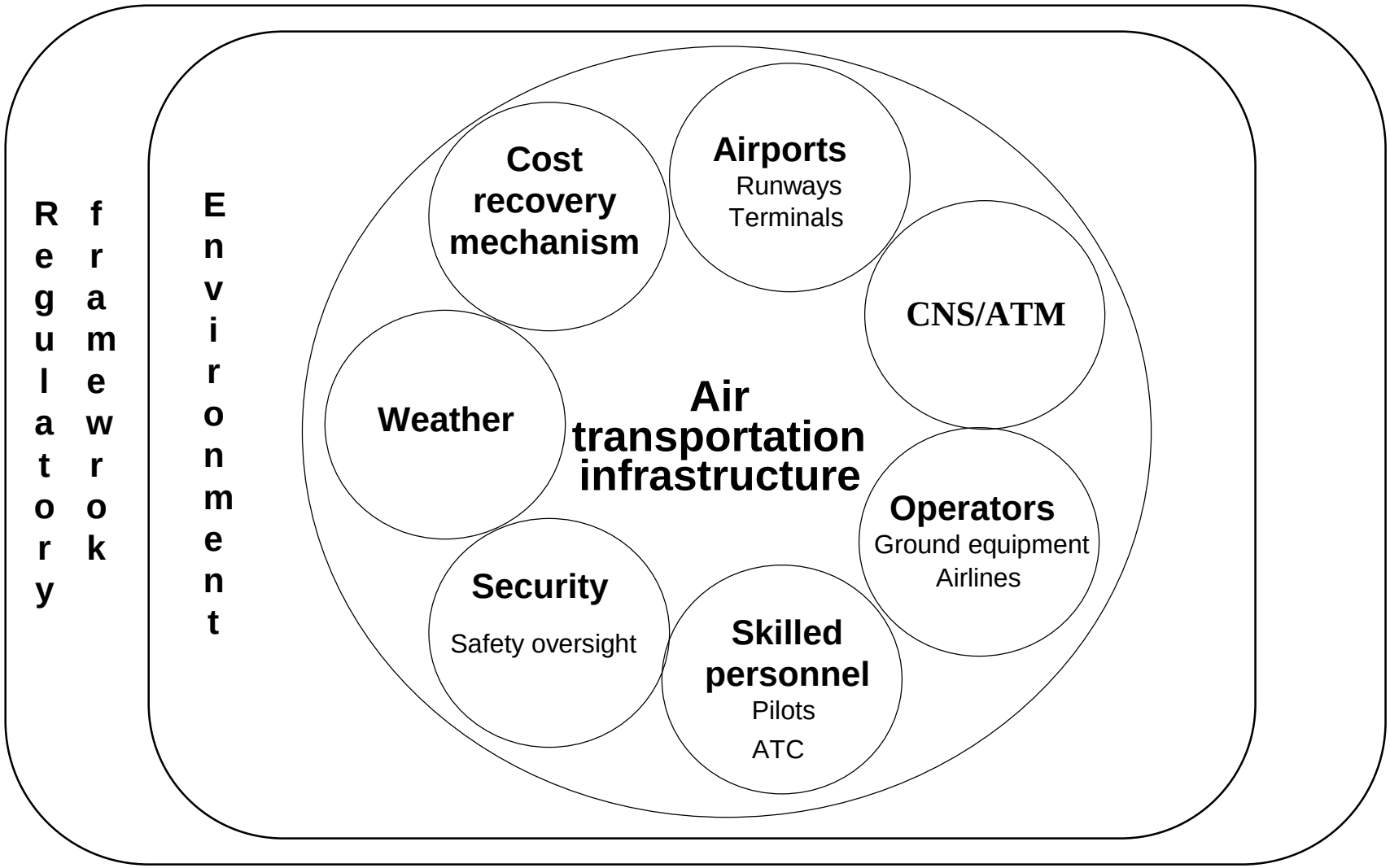
. . . within a given environmental & regulatory context

. . . and supported by **air transportation**

Air transportation infrastructure



Roles of air transportation

	International	Domestic
Passenger travel	Business Leisure (tourism) Medical/emergency	Business Personal: tourism, GA Medical/emergency
Cargo	Courier/mail Exports Imports	Courier/mail Commercial cargo
Agriculture		Crop dusting
Response to natural disasters	Search & Recovery Evacuation Redundancy to transportation network Airlifts	

Others: Security/surveillance, monitoring of pipelines, etc.

Global impact: macro (state) level

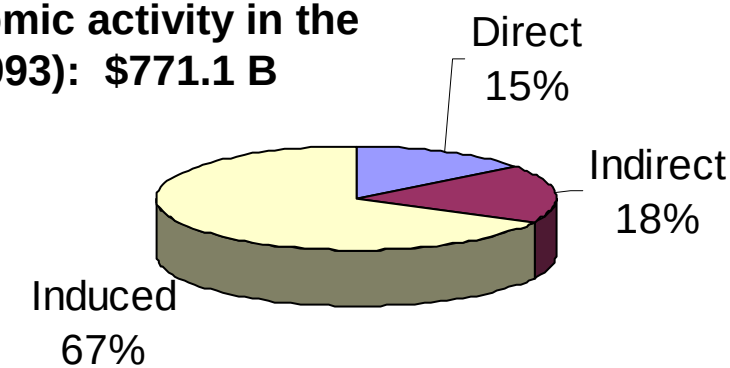
- **Focus on major worldwide trends:**
  - Air passenger travel
  - Tourism
  - Air cargo
  - Adverse effects
  - Shocks to the system
- **Mostly international air transportation**

Impact of aviation at a macro (state) level

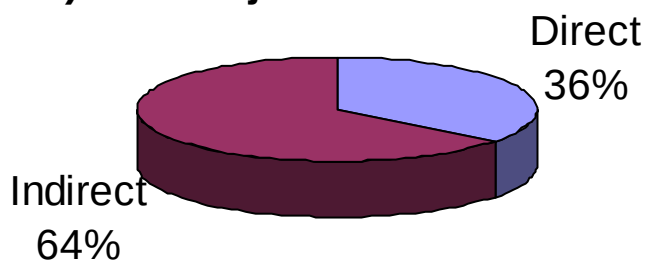
- **Air transportation has three types of effects*:**
  - **Direct**: value of all economic activities attributable to air carriers, airports, air navigation providers, etc
  - **Indirect**: value of all economic activities attributable to airline passengers and air freight forwarding business in other industries (hotels, rental cars, finance and banking, etc)
  - **Induced**: expenses by the recipients of income generated by the direct and indirect economic activities

*enabling effect: some activities would not be possible without aviation

Economic activity in the US (1993): $771.1 B



Employment in the US (1993): 8.84 M jobs



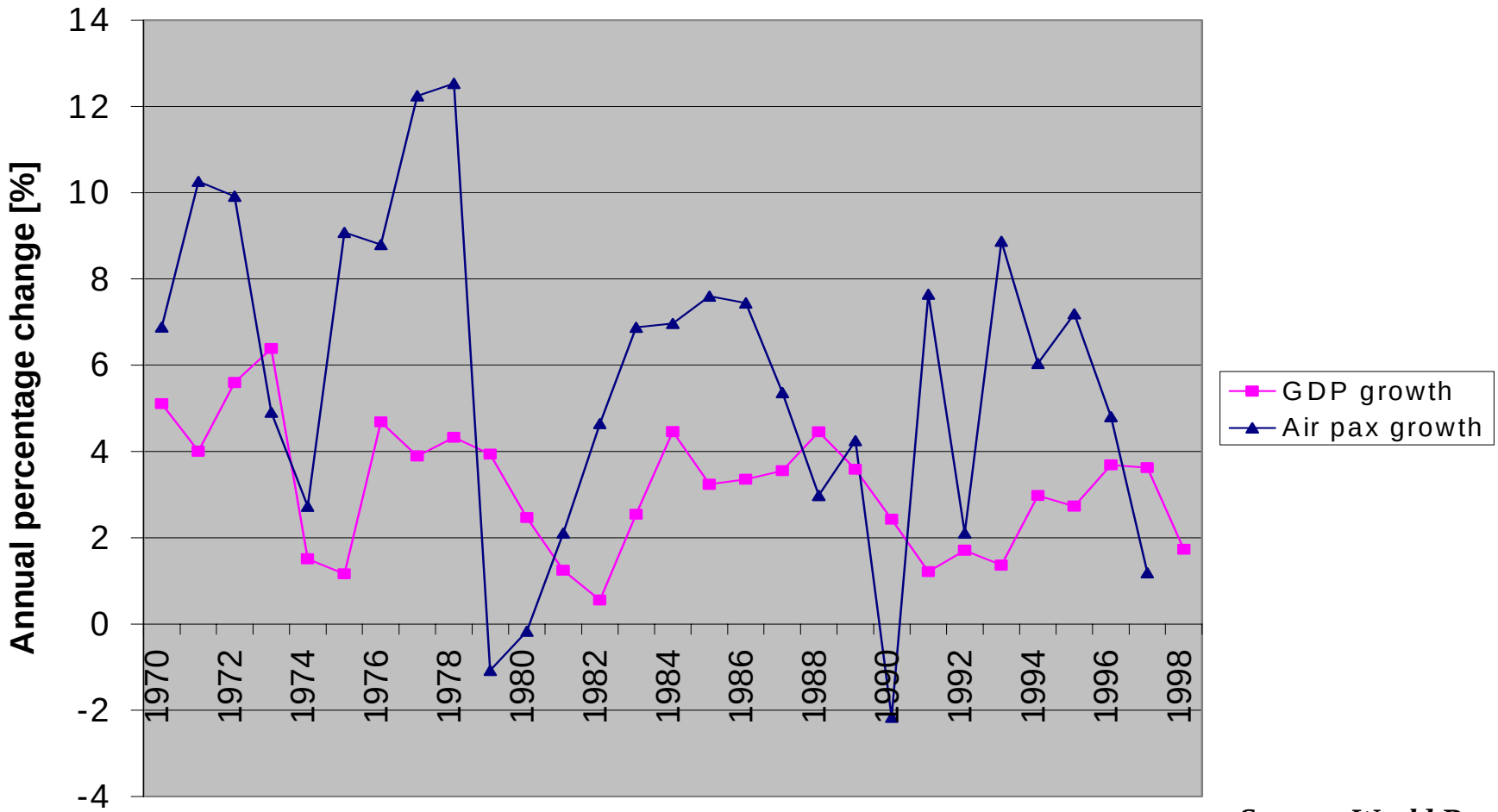
Source: ICAO, FAA

Global impact of aviation

- **Direct employment worldwide (1996):**
  - Airlines: 1.8 million
  - Aerospace: 1.2 million
  - Airports: 1.1 million
- **Economic impact (revenues, 1996):**
  - Airlines: US$ 325.2 billion
  - Aerospace: US$ 117.6 billion
  - Airports: > US$ 24 billion
- **Support industries (1996):**
  - Civil jet fuel market: US$ 42 billion
  - Aircraft maintenance business: US$ 10 billion, 65,000 jobs
  - Catering business: US$ 6.1 billion, 96,000 jobs
  - CRS revenues: US$ 4.4 billion, 19,000 jobs

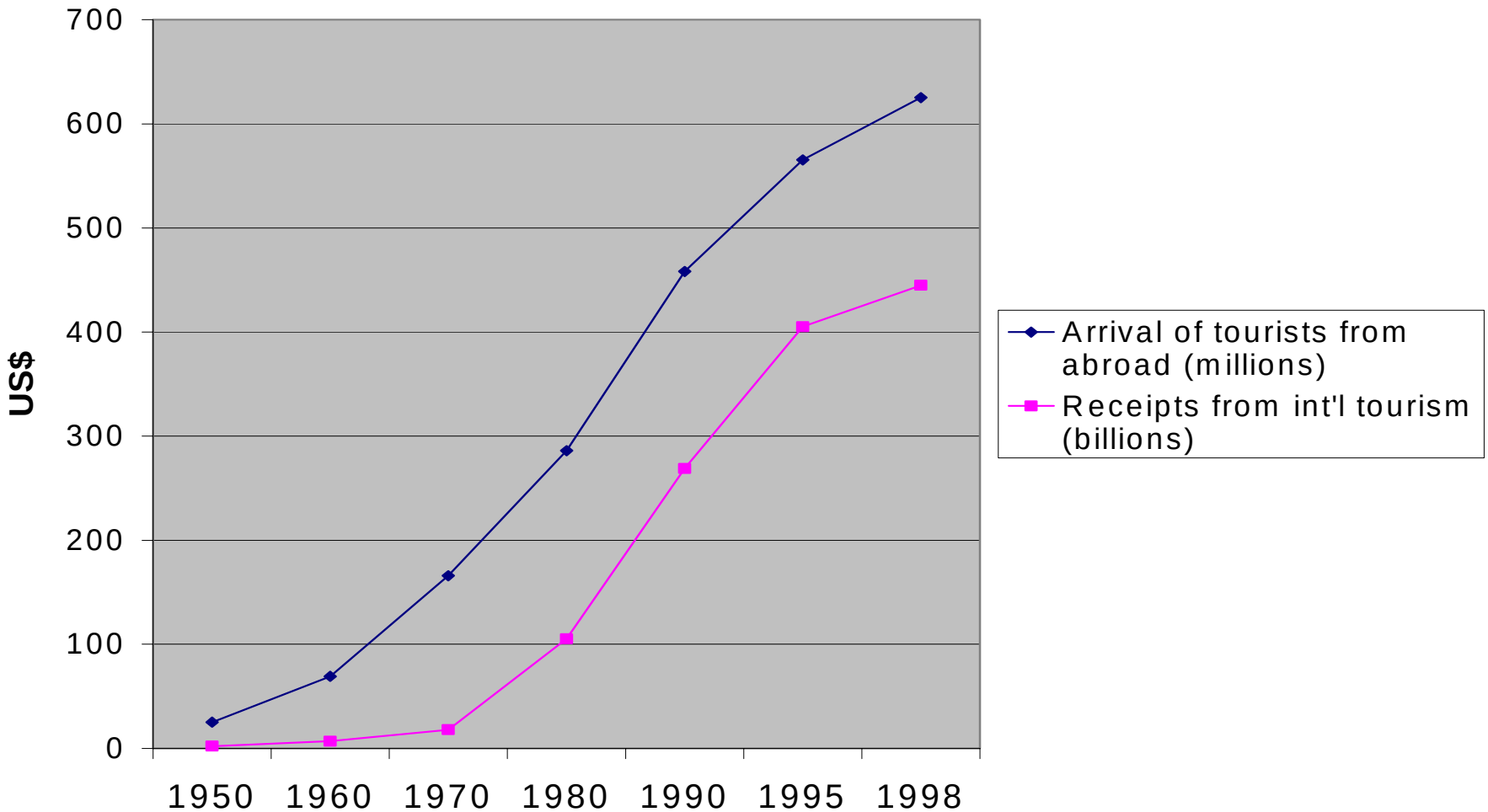
Source: ICAO, FAA

World GDP and aviation growth



Source: World Bank

World tourism



Source: World Tourism Organization

Impact of tourism varies by country

- **Ratio of international tourism receipts to GNP:**
- **Highest (> 10%) in island countries and low/middle income countries:**

Maldives	99.7%
St. Lucia	51.4%
Jamaica	27.9%
Seychelles	23.0%
Samoa	20.2%
Malta	19.3%
Cyprus	19.3%
Jordan	14.8%
Fiji	14.5%
Belize	13.9%
Ukraine	10.1%
Estonia	10.1%

Source: World Bank

Impact of tourism varies by country

- **Ratio of international tourism receipts to GNP**
- **High (>5%) in low/middle income countries with few important important exceptions:**

Namibia	10.0%
Tonga	8.7%
Paraguay	7.8%
Costa Rica	7.5%
Singapore	6.1%
Poland	6.1%
Hungary	5.8%
Austria	5.3%
Hong Kong	5.3%
Spain	5.1%

Source: World Bank

Impact of tourism varies by country

- **Ratio of international tourism receipts to GNP:**
- **Lower significance in other countries:**

Switzerland	2.9%
France	2.0%
Netherlands	1.7%
United States	0.9%
Germany	0.8%
Japan	0.1%
Uzbekistan	0.1%
Sudan	0.04%
Algeria	0.04%
Congo, Dem. Rep.	0.04%

Source: World Bank

Air cargo

- **Aviation enables *fast* transportation of goods over *long* distances**
- **Typical goods transported by air:**
  - Mail
  - Perishable products: flowers, seafood
  - High-value/low weight goods: micro-components
  - Courier, express delivery
- **Recent trends:**
  - “full-solution providers”: hauling, fee collection, financing
  - Introduction into supply chain

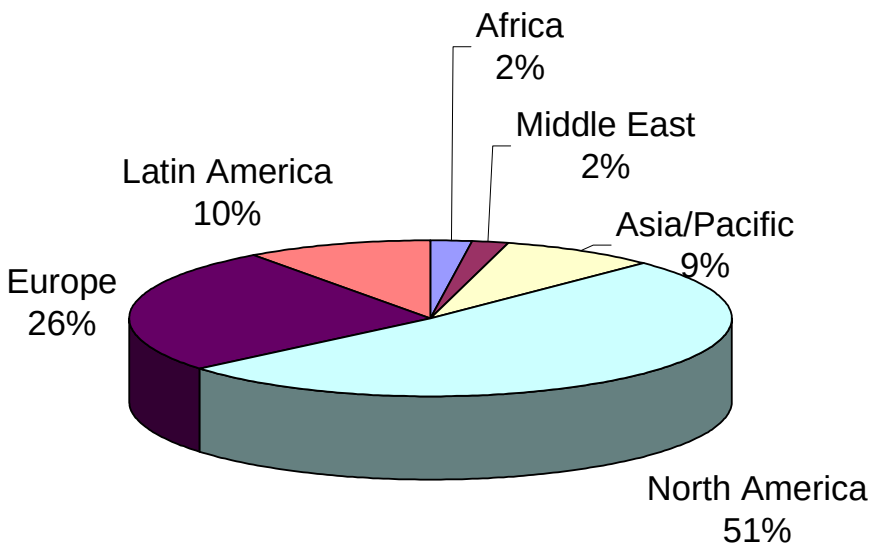
Air cargo and international trade

- Approx. 1/3 of world's exports by value transported by air
- 1996, air freight was 23 million tones (14 million international, 9 9 million domestic)
- World revenues estimated at $150 billion (2001)

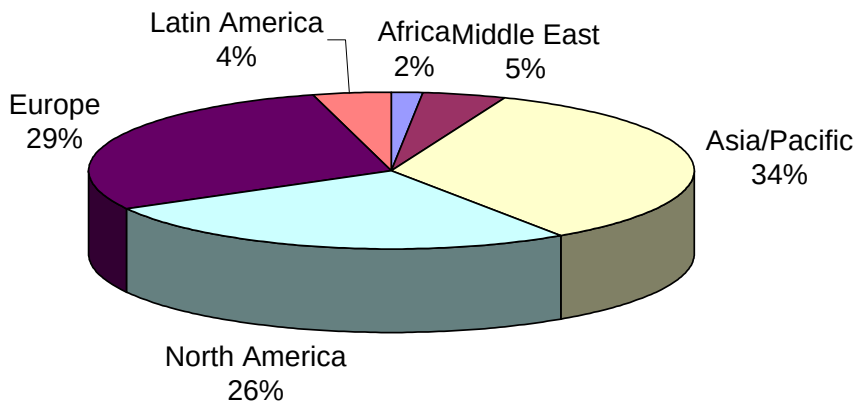
Sources: ICAO, AW&ST

Air cargo trends

	1961	1996
Int'l freight (million ton-km)	**1,130**	**74,827**
Dom. Freight (million ton-km)	**1,230**	**13,328**



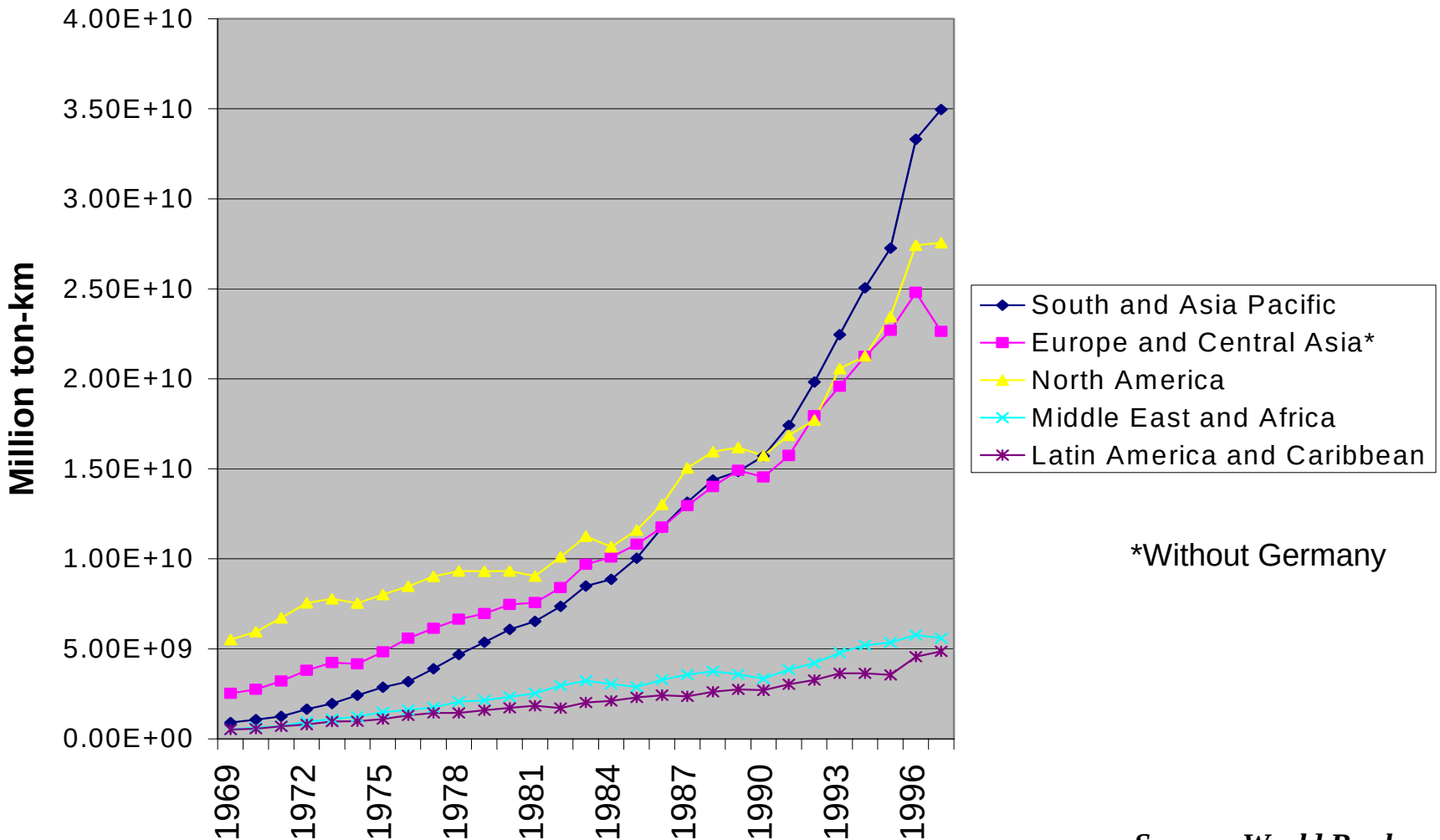
1961



1996

Source: ICAO

Air freight over time



*Without Germany

Source: World Bank

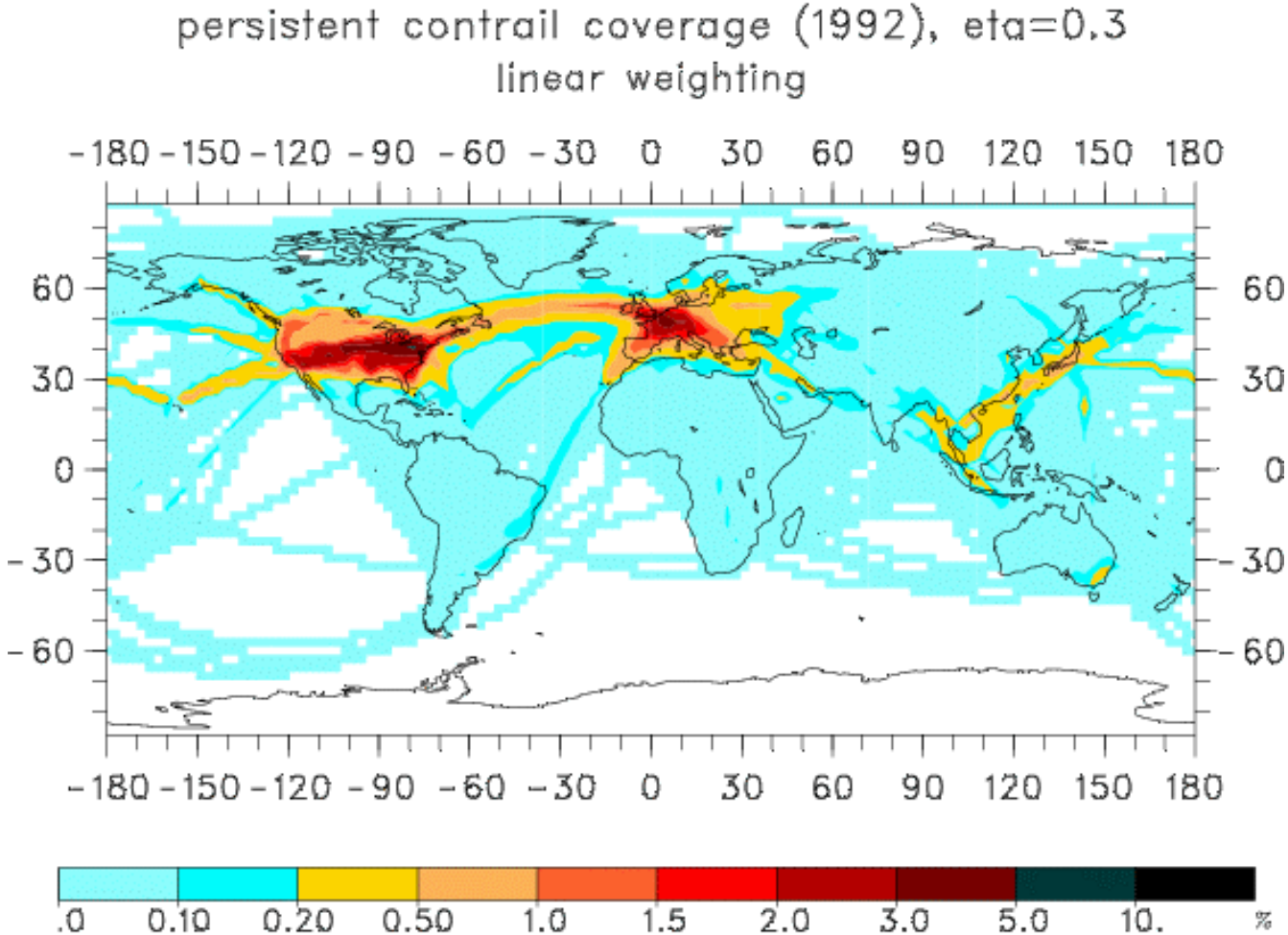
Adverse effects of air transportation

- **“Everybody would like an airport nearby but not too near”**
  - Noise
  - Emissions
  - Depreciation of land value
  - Safety

Aircraft noise

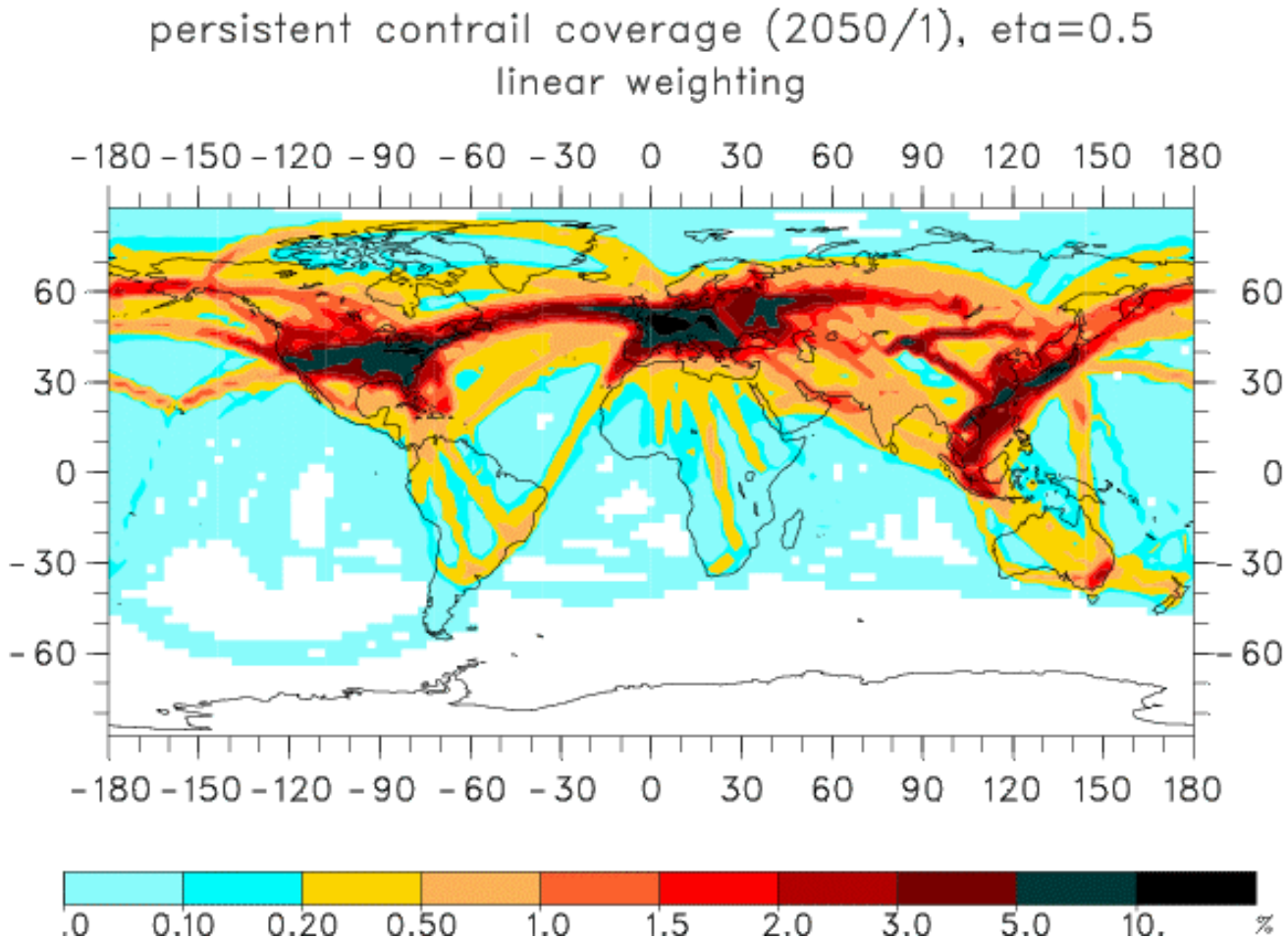
- **Detrimental effects on human health (esp. around residential areas):**
  - Ability to concentrate at work and school
  - Sleep deprivation
  - Decrease in land value
- **Constraints in air traffic control limit implementation of procedures to minimize aircraft noise**
- **Citizen's groups are powerful force shaping aircraft noise debate and influencing airport capacity expansion**

Contrail coverage (1992)



Source: Deutsche Luft- und Raumfahrt Zentrum (DLR)

Contrail coverage (2050, est.)



Source: Deutsche Luft- und Raumfahrt Zentrum (DLR)

Shocks in the air transportation system . . .

- **The events on September 11, 2001 had a decisive effect on the the aviation sector:**
  - First complete shutdown of the US National Airspace System (NAS) (NAS) in history
  - Triggered a crisis in an already hurting industry:
    - Boeing layoffs: 20,000 – 30,000
    - Total layoffs of US major airlines: > 100,000
    - Average schedule reductions of US major airlines: 20%
    - European losses during shutdown: $171.4 million
    - Worldwide airline losses this year: $10 billion
  - Losses to the economy due to business disruption: ???
  - Human losses: unimaginable

Sources: Aviation Week & Space Technology, International Herald Tribune

. . . are felt worldwide

- **Jamaica:**
  - Drastic reduction in tourist bookings
  - Perishable products stacked in airlift warehouses deteriorate
  - Business relations hurt because of disruptions in courier service
  - New security measures may affect negatively handling of perishables perishables

  Source: Jamaica Gleaner

- **Alaska → disconnected from the world:**
  - Has few highways and depends more heavily on aircraft to move people and goods, relative to population
  - Some towns depend on aviation for health service, staple groceries

  Source: News Tribune

- **Costa Rica:**
  - 56% of tourism comes from the US
  - Experts forecast $200-300 million losses in a year's period
  - Government asking European airlines to offer direct service

  Source: Periódico La Nación

Local impact of air transportation

- **Focus on areas distant from major cities:**
  - In developed countries
  - In developing countries:
    - Socio-economic trends
    - Vulnerability
- **Served mostly by domestic air transportation**
- **Discussion mostly qualitative due to limited data sources**

Local impact: developed regions

- **Think of small towns served by local (general aviation) airport**
- **Small airports supports economic growth by**
  - Improving communication (personal and corporate)
  - Attracting economic activities
  - Fostering local entrepreneurship
- **The impact of small airports can be limited by**
  - Telecommunications
  - Access to a major airport
  - Use of business jets
- **Key elements for positive economic impact of small airports**
  - Vigorous local economy
  - Political support for economic growth
  - Geographical location away from large airport

Source: Kanafani, A. and Abbas, M., Local air service and economic impact of small airports, 1987

Local impact: developing regions

- **In many countries, trend towards immigration and concentration concentration of economic activities in major urban centers (often national capitals):**
  - Access to services: health, education, water, electricity, government government
  - Access to markets
  - Access to cultural events, entertainment
  - “Dream of a better life”
- **However, often times cities are not capable of absorbing incoming population:**
  - Overcrowding of available housing
  - Unemployment
  - Inability to provide sufficient services
  - Increased vulnerability to natural disasters
    - →Creation of slums around cities
    - →Without population, development of rural areas is difficult

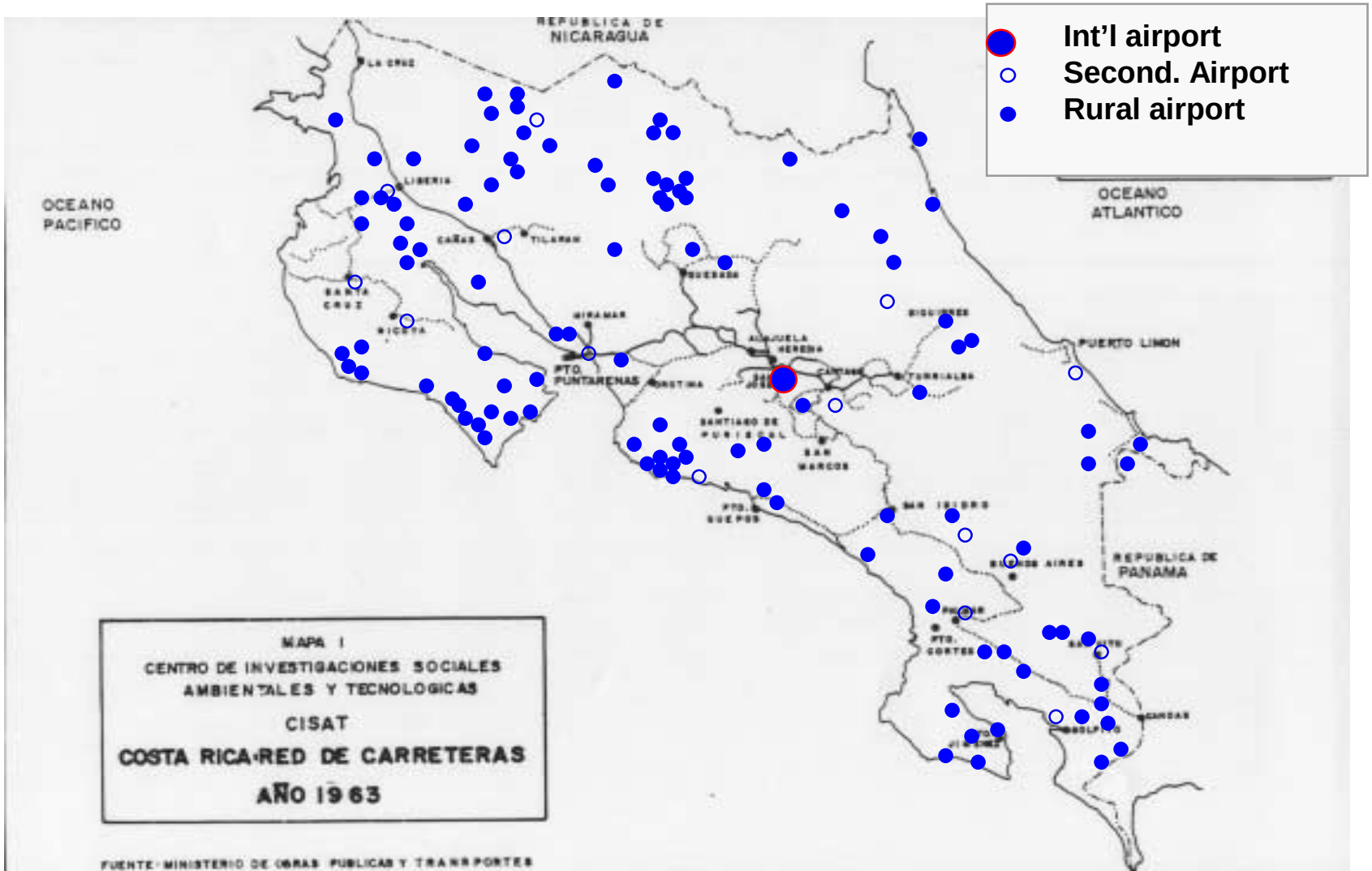
Local impact: developing regions (2)

- **Can air transportation be a factor to revert this trend?**

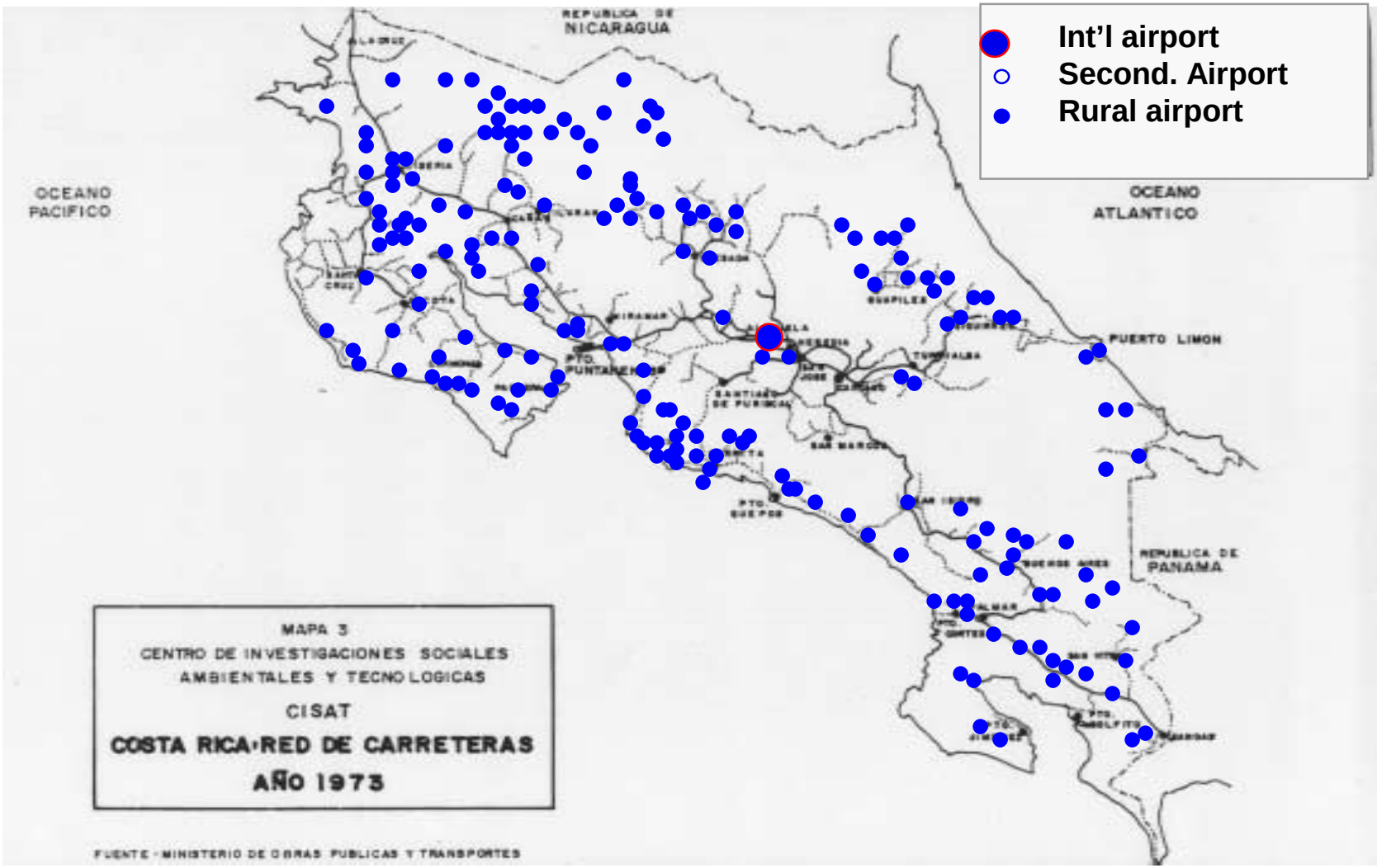
  Depending on local conditions, aviation can be key to:

  - Facilitate/create local businesses (tourism, handcrafts)
  - Facilitate access to markets
  - Facilitate access to services
  - Be an alternative to a “promised” road connection that never comes
  - Enhance image and attractiveness of region

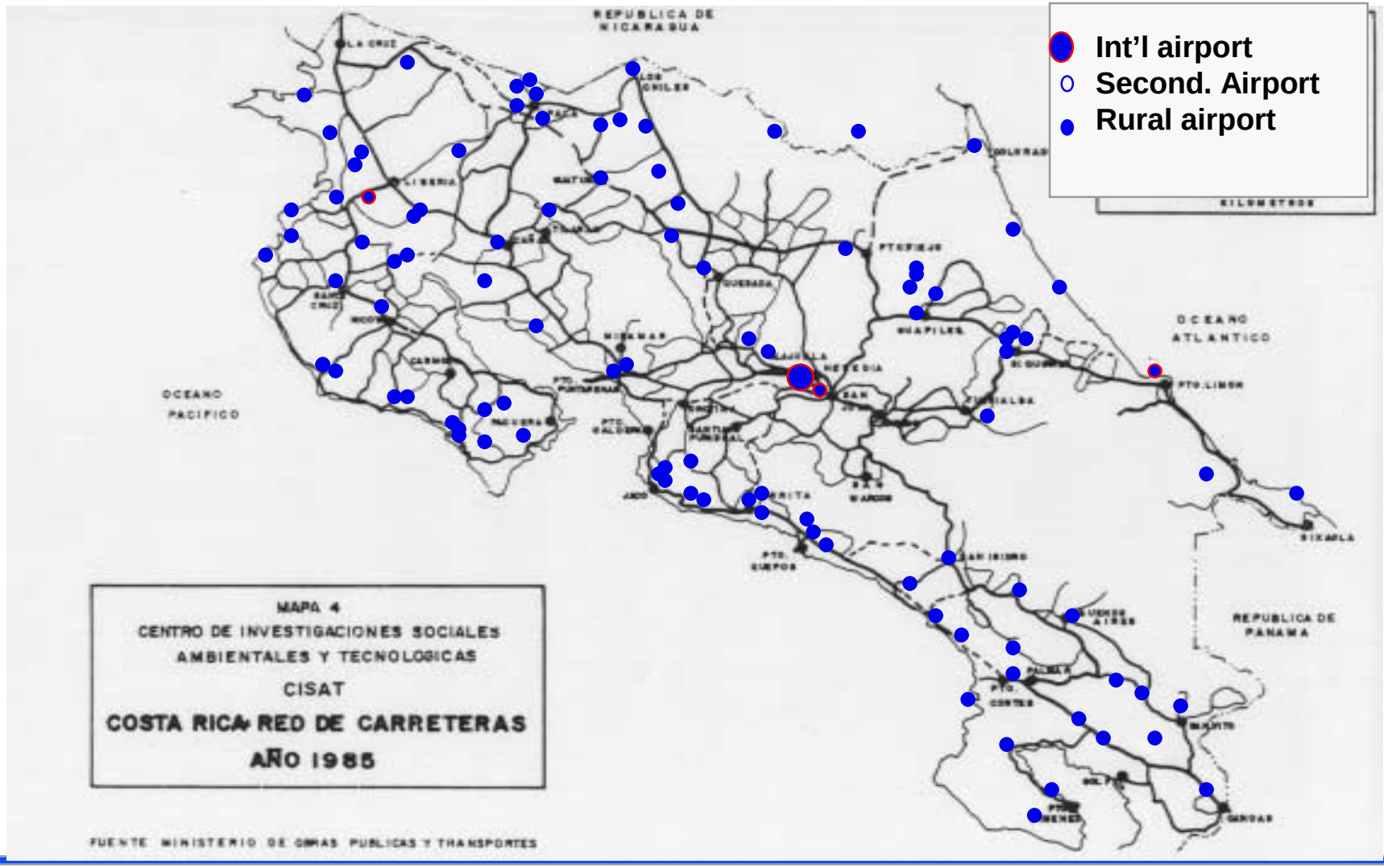
Costa Rica, 1963-64



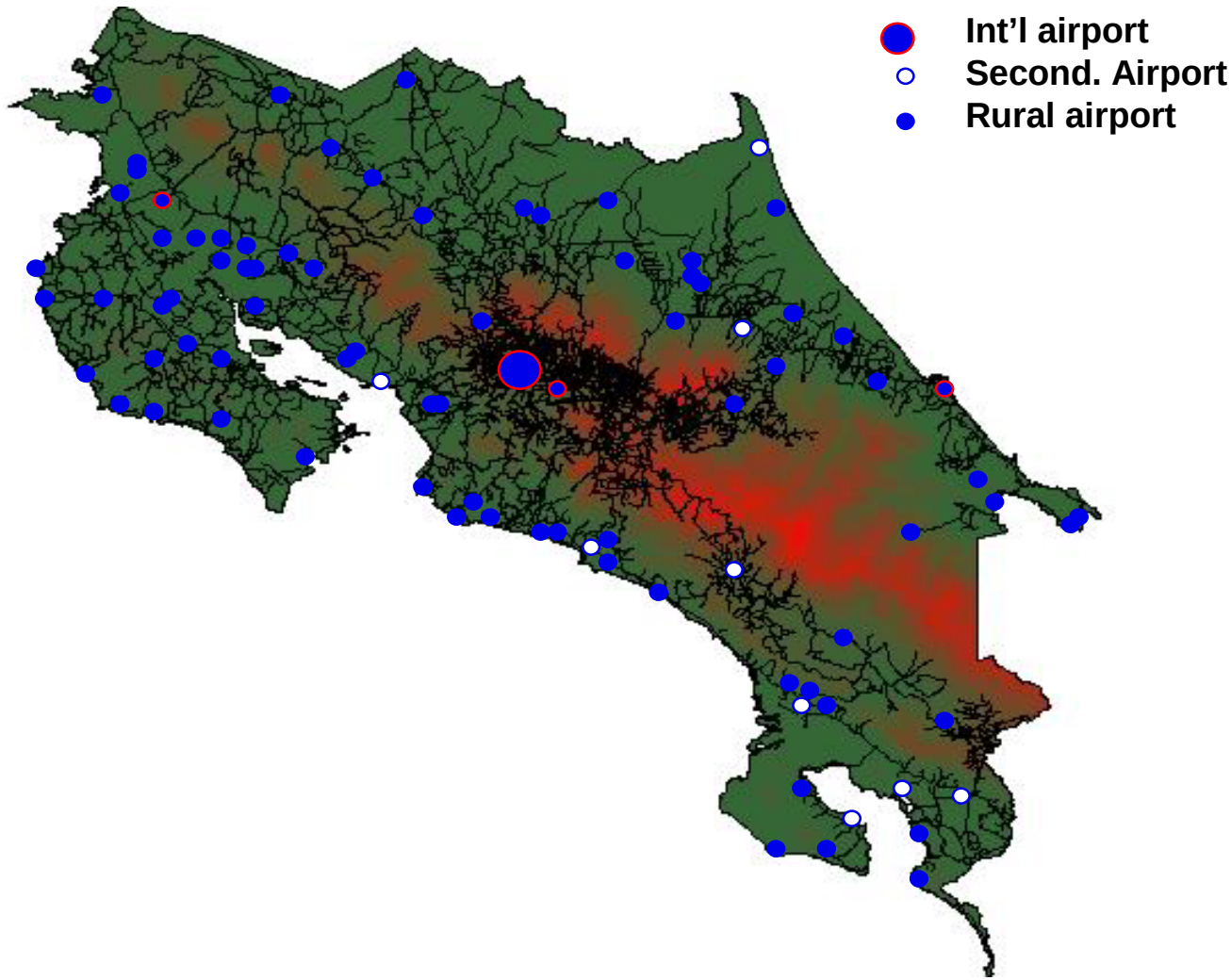
Costa Rica, 1973



Costa Rica, 1982-85



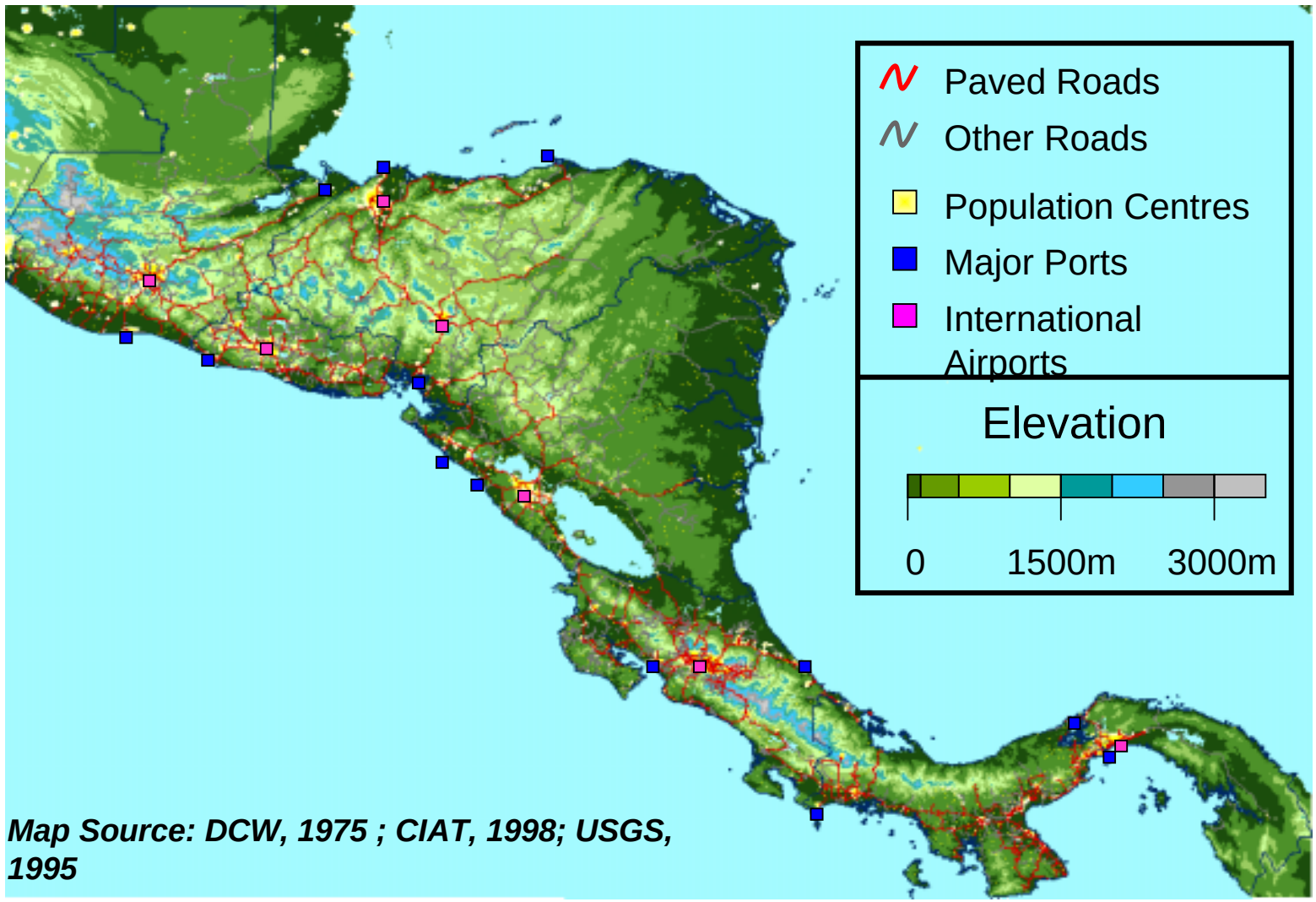
Costa Rica, 1991



Local impact: reducing vulnerability

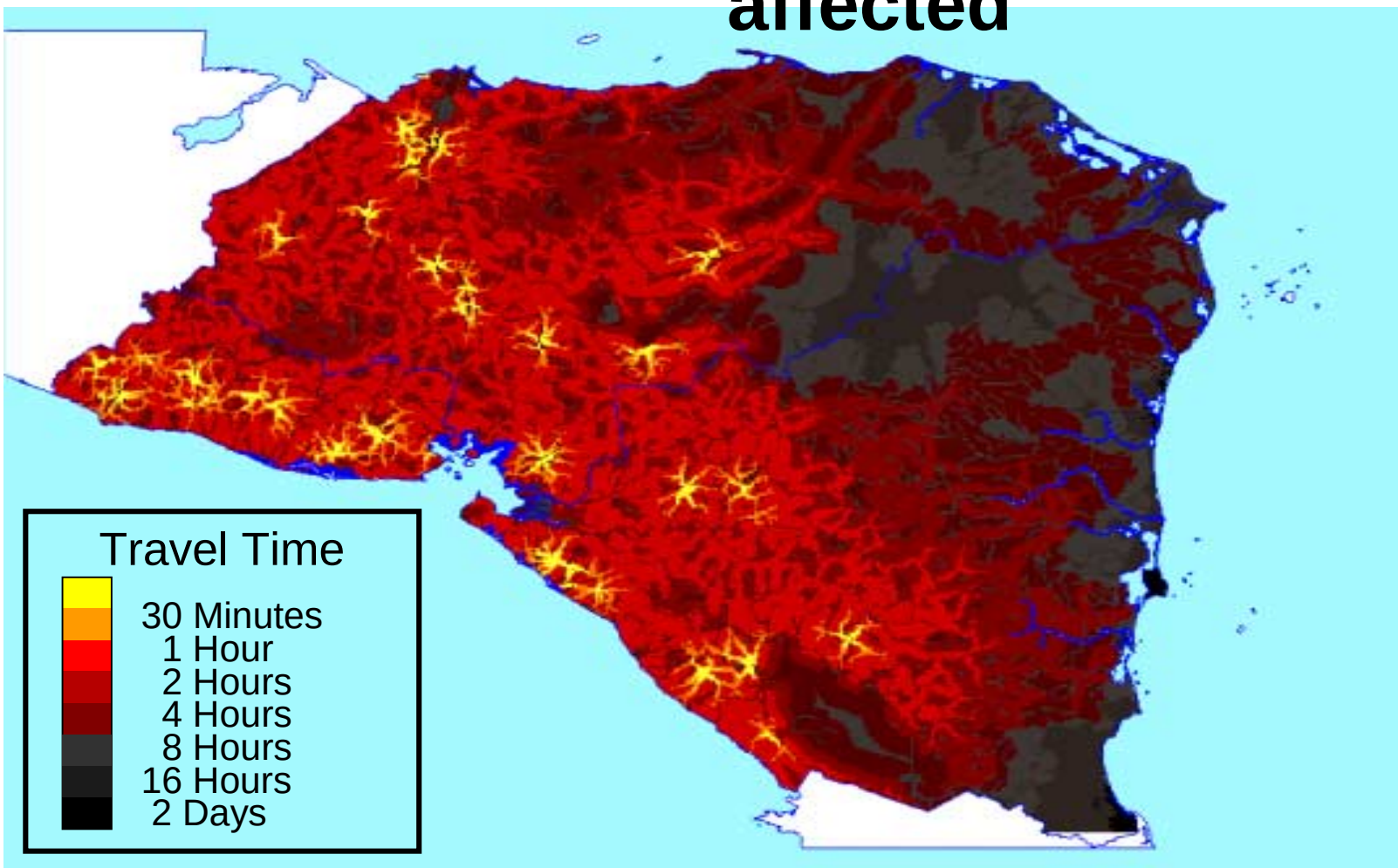
- **Air transportation can be a key element to reduce vulnerability vulnerability to natural disasters:**
  - Provides redundancy to surface transportation network
  - Enables search and rescue operations; evacuations
  - Facilitates contact to outside in reconstruction period → key to reestablish the economy
- **Example: Central America**
  - Region prone to:
    - Tropical storms and hurricanes
    - Volcanic activity
    - Earthquakes
    - Flooding

Local impact: reducing vulnerability (4)



Source: Consultative Group Meeting for the Reconstruction and Transformation of Central America

Accessibility to markets before before MITCH in areas affected affected



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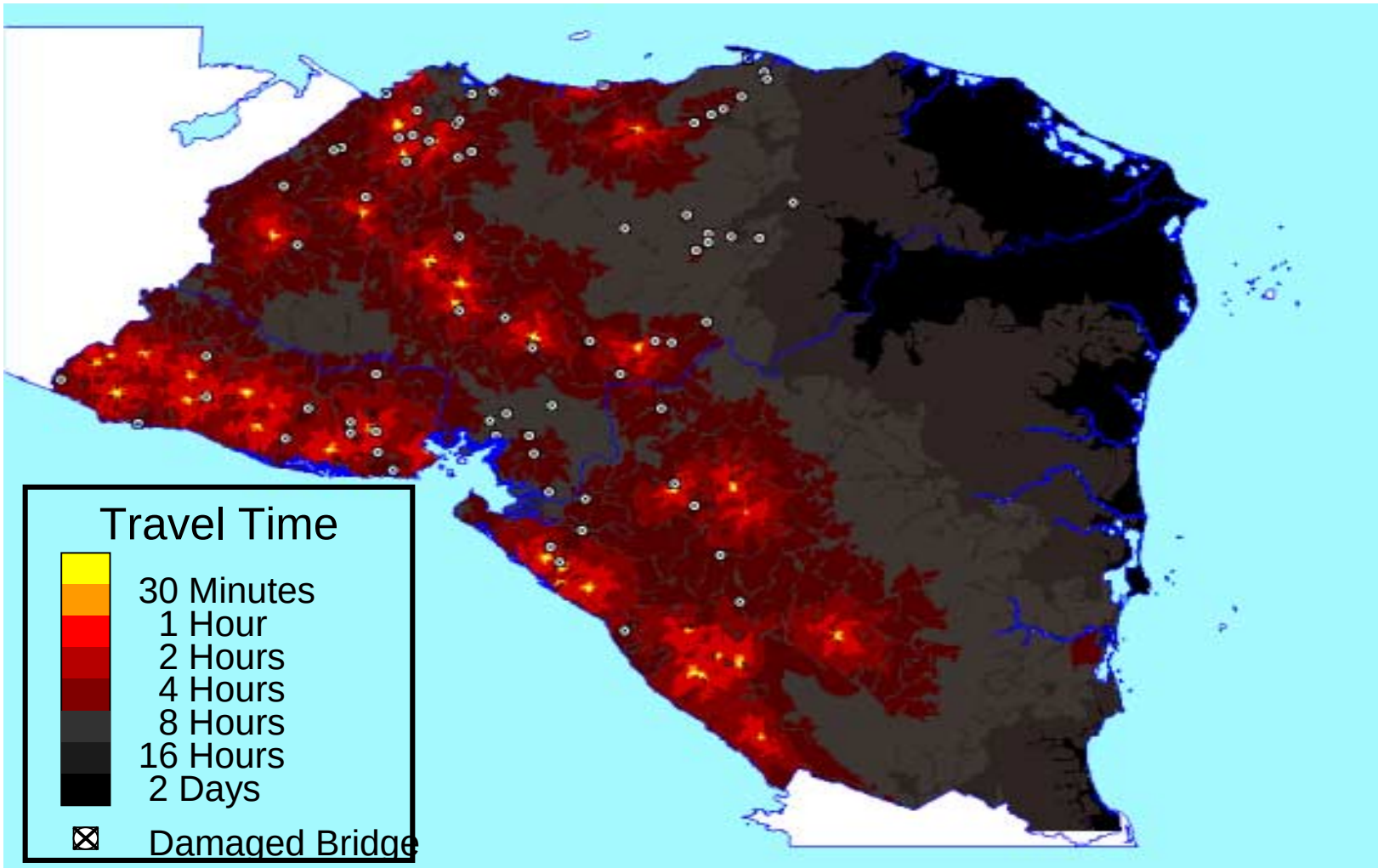
Accessibility to markets after MITCH in areas affected



Source: Consultative Group Meeting for the Reconstruction and Transformation of Central America

Difficulties with local air transportation

- **Limitations to development of aviation services:**
  - Infrastructure investments
  - Quality of service:
    - Frequency
    - Reliability
    - Total trip time vs. aircraft trip
  - Safety
  - Maintenance
  - Skilled personnel
  - Communication, navigation, surveillance

- **Notice: adverse topographical and weather conditions may hinder air transportation, as well.**

Summarizing

- **Air transportation has a significant economic and social impact impact on developed and developing regions:**
  - Passenger travel, tourism, air cargo
  - Direct, indirect, induced effects
- **Aviation can be a key factor in the socioeconomic growth of underdeveloped areas:**
  - Provides access to markets, services, etc
  - Enables business activities
  - Reduces vulnerability
- **If there are many advantages, why are investments in aviation infrastructure not a priority?**

Investments in aviation infrastructure

- **Chicken and egg problem for many regions:**

  "Need aviation traffic to justify investments in infrastructure"

  "Aviation infrastructure is needed to attract traffic"

- **Often, revenues from aviation are:**
  - Substantial:
    - Worldwide landing fees (2000): ~ $7 billion
    - Worldwide over-flight fees (2000): ~ $7.2 billion
  - But not re-invested in the aviation sector necessarily:
    - Sometimes diverted to general funds
    - Sometimes diverted to other parts of the government/economy

- **Air transportation is expensive (?)**
  - Compared to which alternatives?

Source: IATA

Future work

- **MIT study:**
  - systems engineering analysis . . .
  - . . . to understand the *key factors . . .*
  - . . . to support *rational investment* in *aviation infrastructure . . .* .
  - . . . by governments and international lenders (e.g. World World Bank),
  - . . . and to *promote economic* and *social growth* . . .
  - . . . in a manner which increases *safety* . . .
  - . . .and minimizes adverse *environmental* impact.

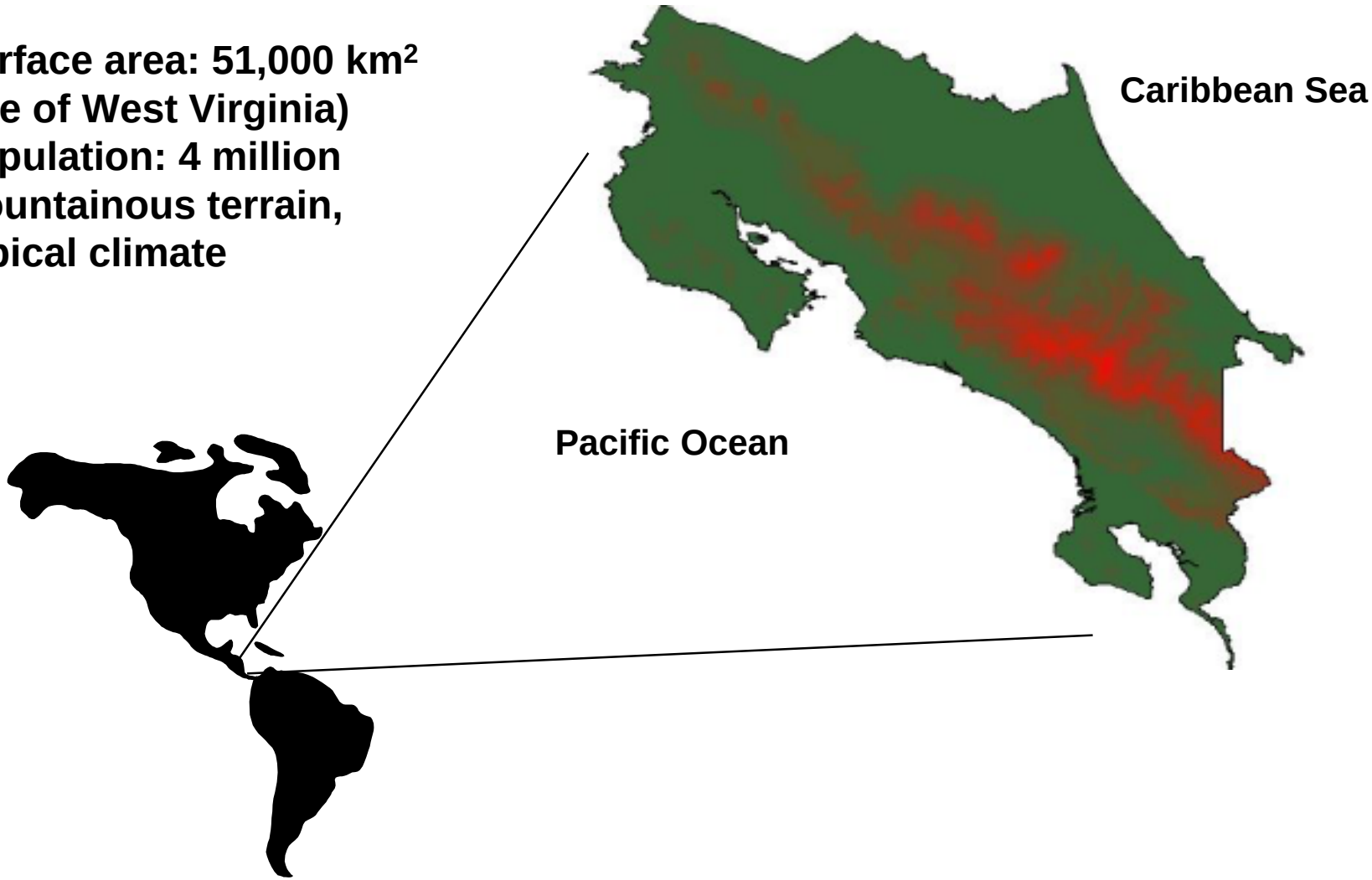
Thank you!

Local impact: conclusions

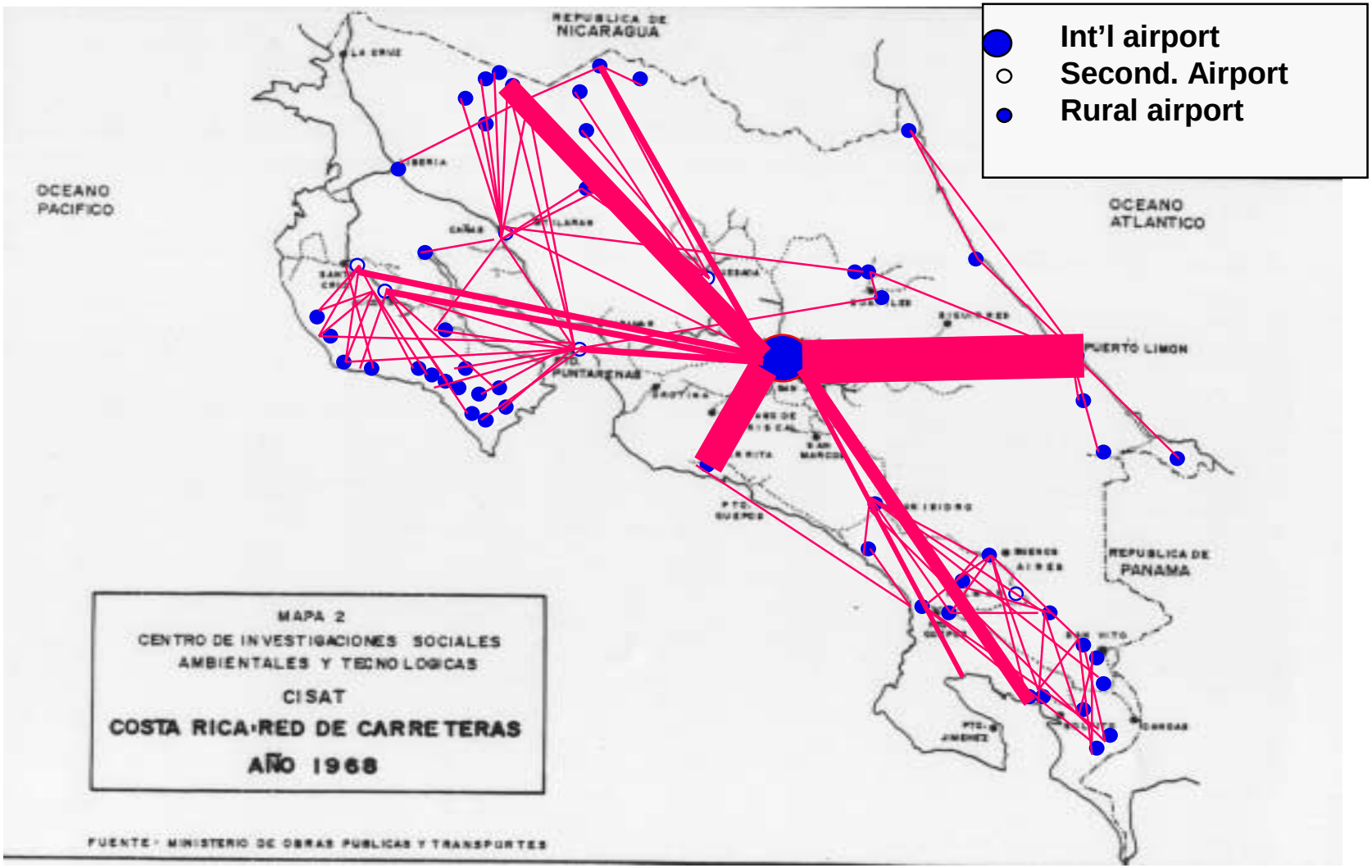
- **Air transportation should be contemplated within a broader socio-economic context**
- **Aviation is part of a multi-modal transportation system**
- **Air transportation *per se* is not the solution to the development development challenge, but is a supporting/enabling/catalyzing supporting/enabling/catalyzing factor**

Costa Rica

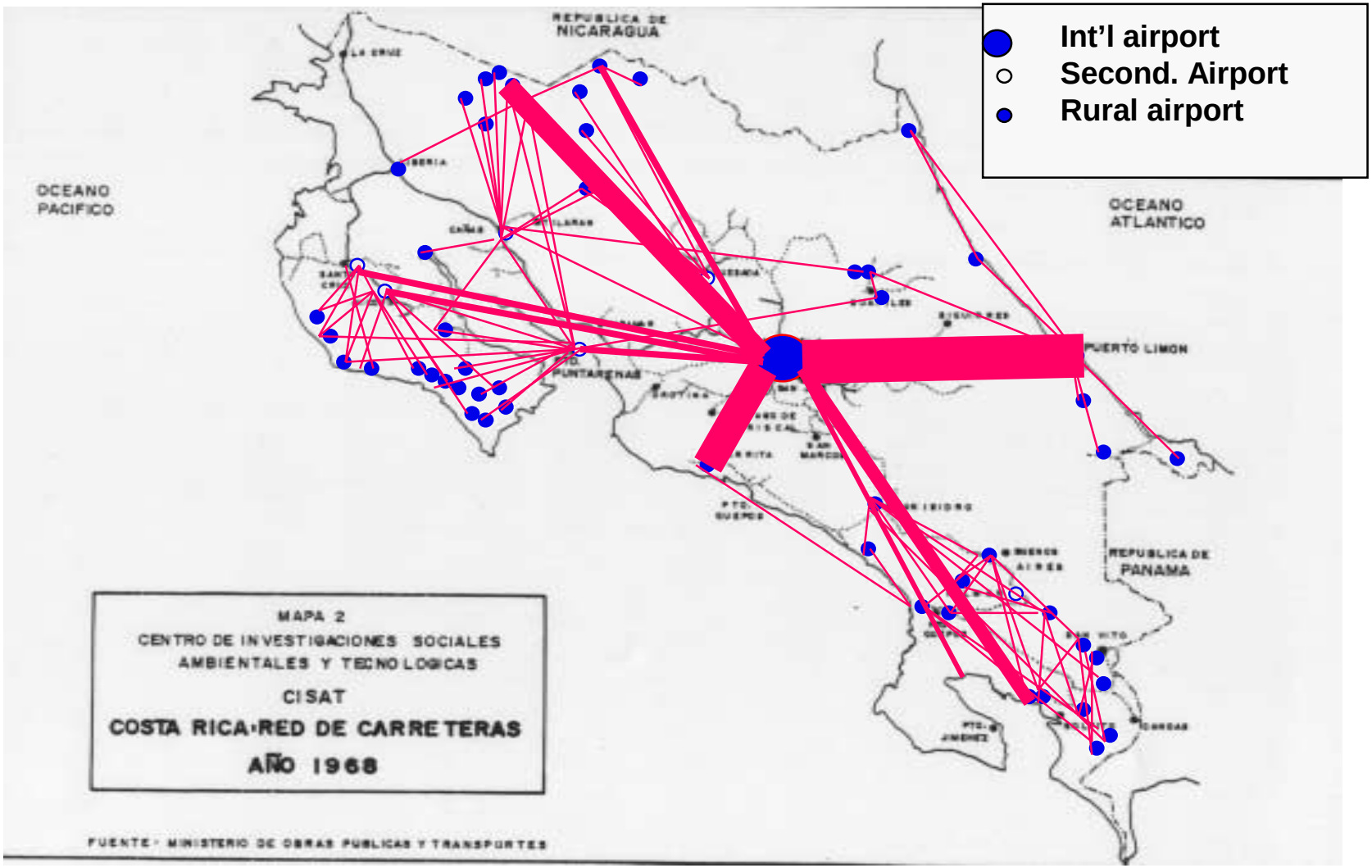
- Surface area: 51,000 km^2 (size of West Virginia)
- Population: 4 million
- Mountainous terrain, tropical climate



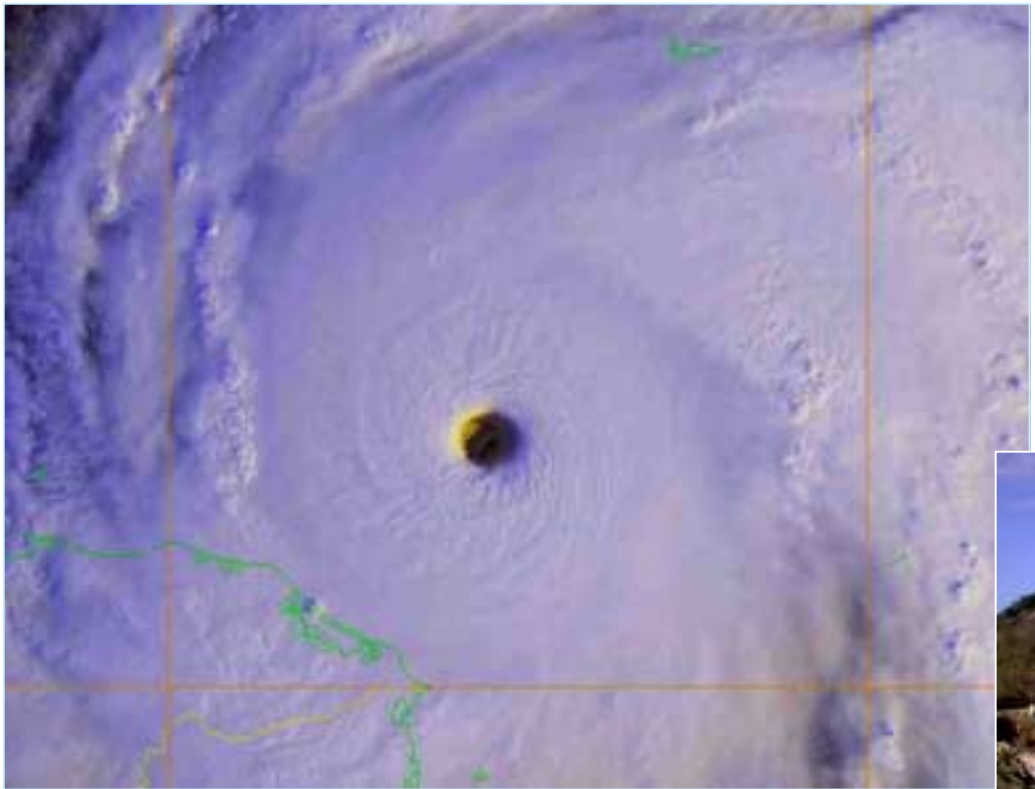
Costa Rica, 1967-1968



Costa Rica, 1967-1968



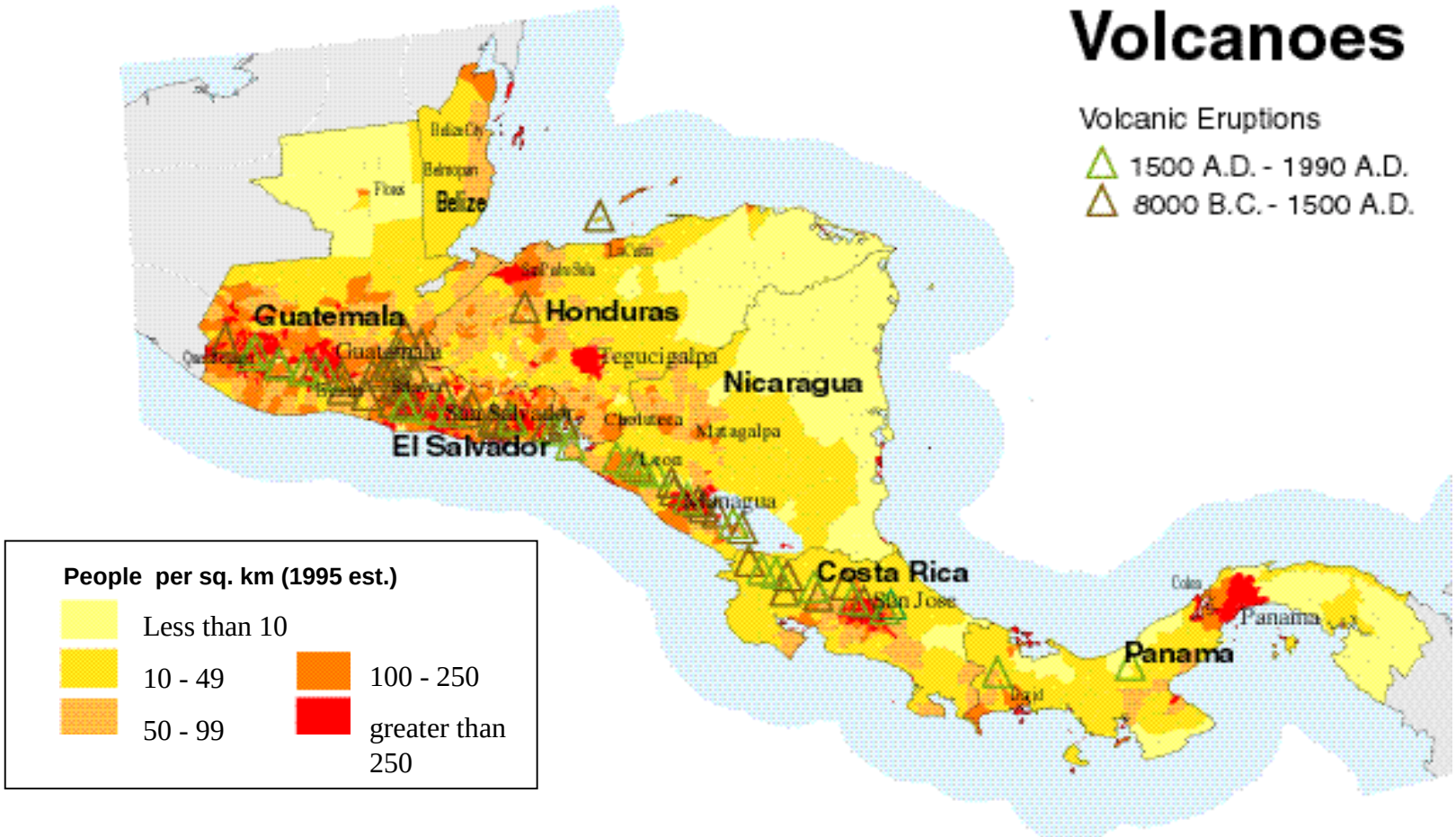
Hurricane MITCH hits Central America in October, 1998



- 11,000 deaths
- 12,940 injured
- 2 million homeless
- 254 bridges destroyed

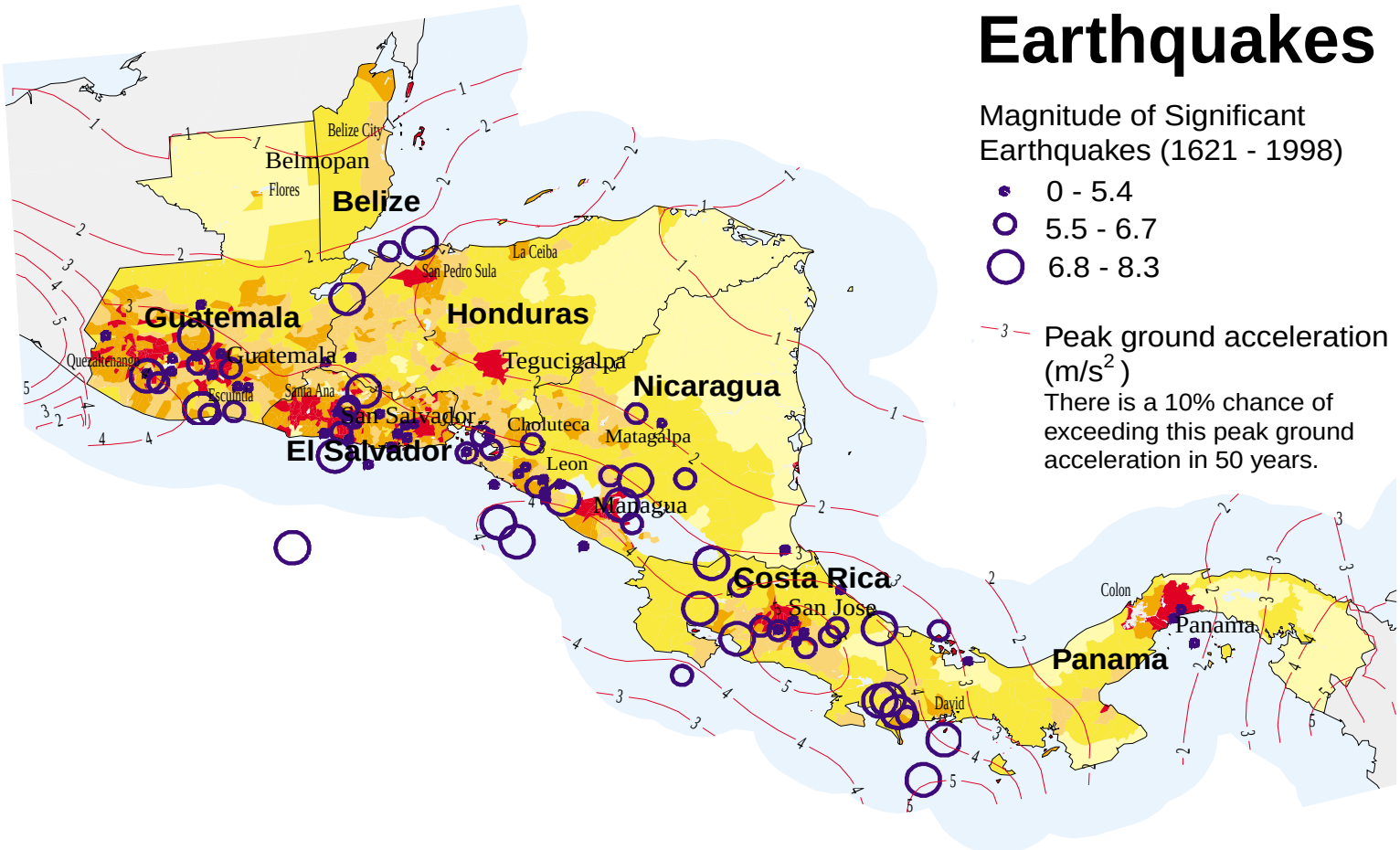
Source: Consultative Group Meeting for the Reconstruction and Transformation of Central America

Local impact: reducing vulnerability (2)



Source: Consultative Group Meeting for the Reconstruction and Transformation of Central America

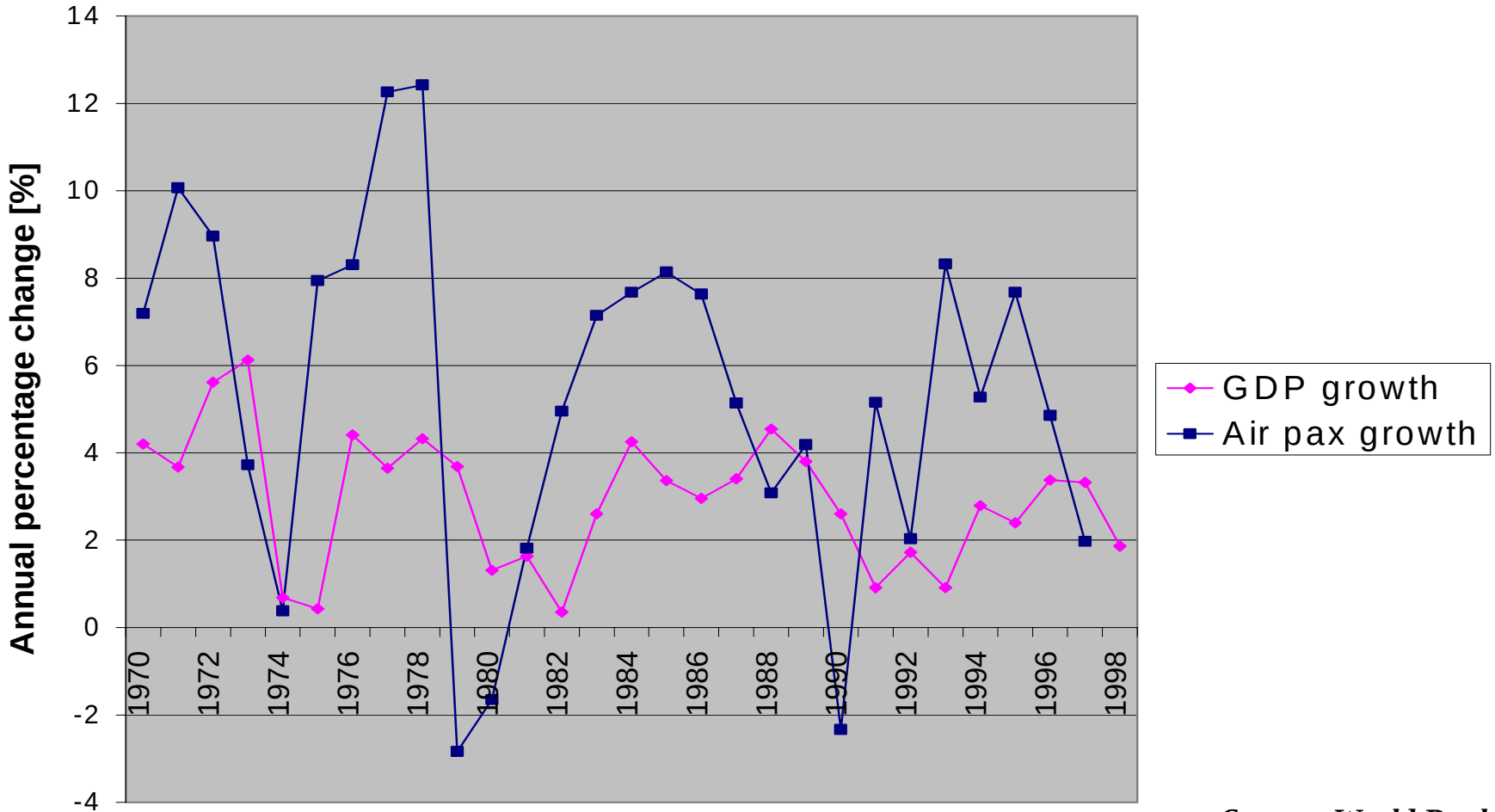
Local impact: reducing vulnerability (3)



Data source: NOAA NGDC Significant Earthquake Database, http://www.ngdc.noaa.gov/seg/hazard
Shedlock, K.M. 1998. Seismic Hazard Map of North and Central America and the Caribbean. USGS.

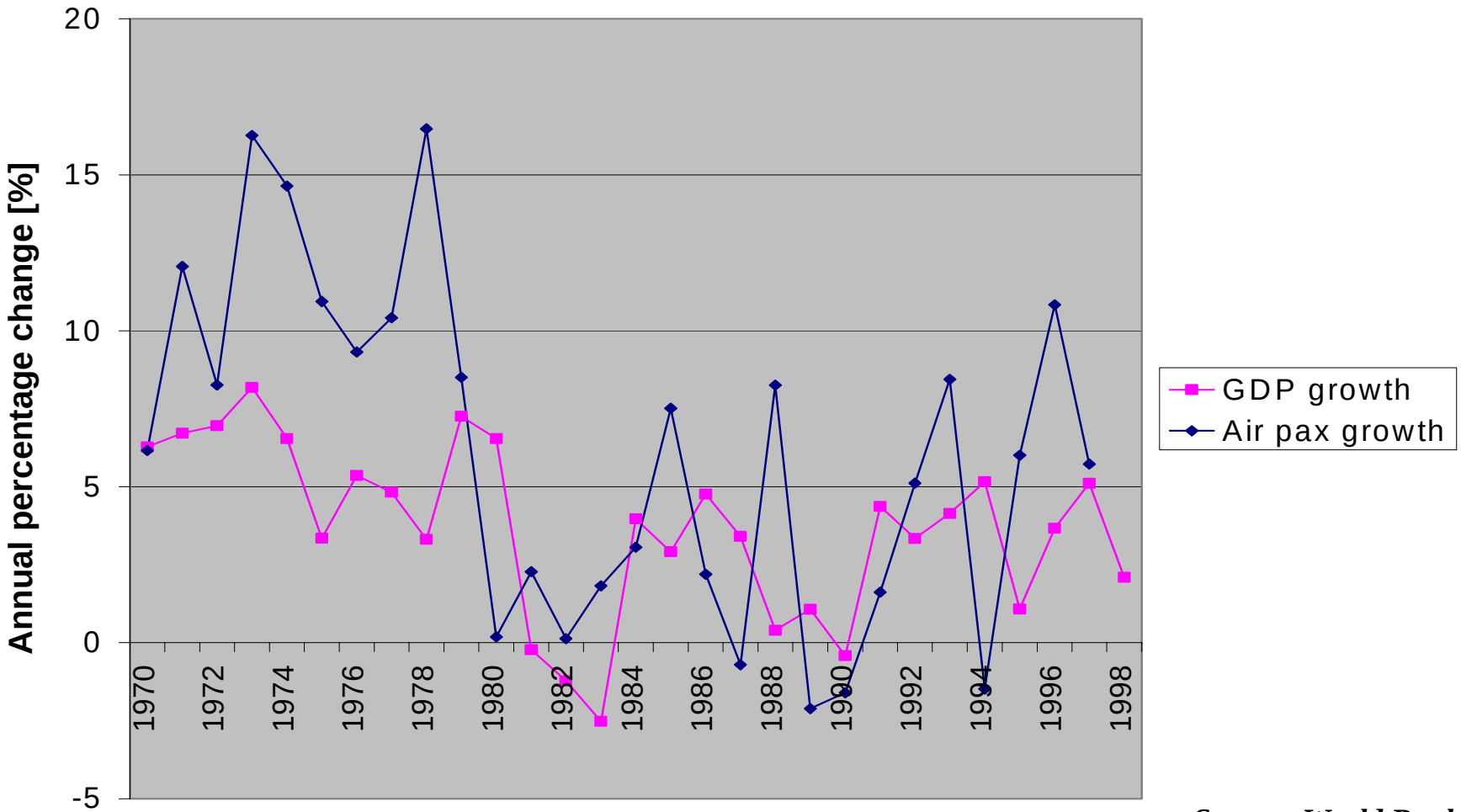
Source: Consultative Group Meeting for the Reconstruction and Transformation of Central America

High income countries



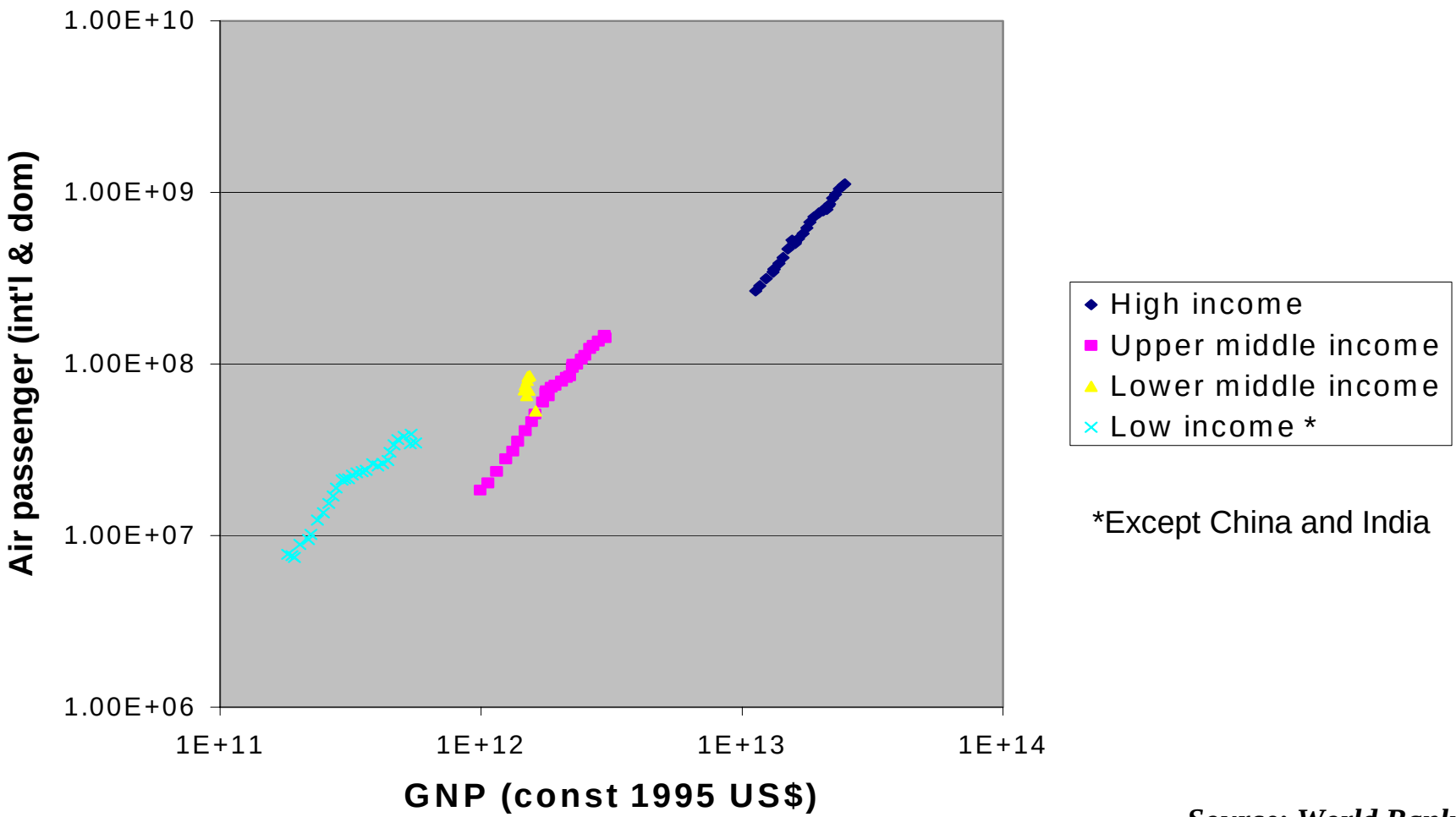
Source: World Bank

Latin America and Caribbean



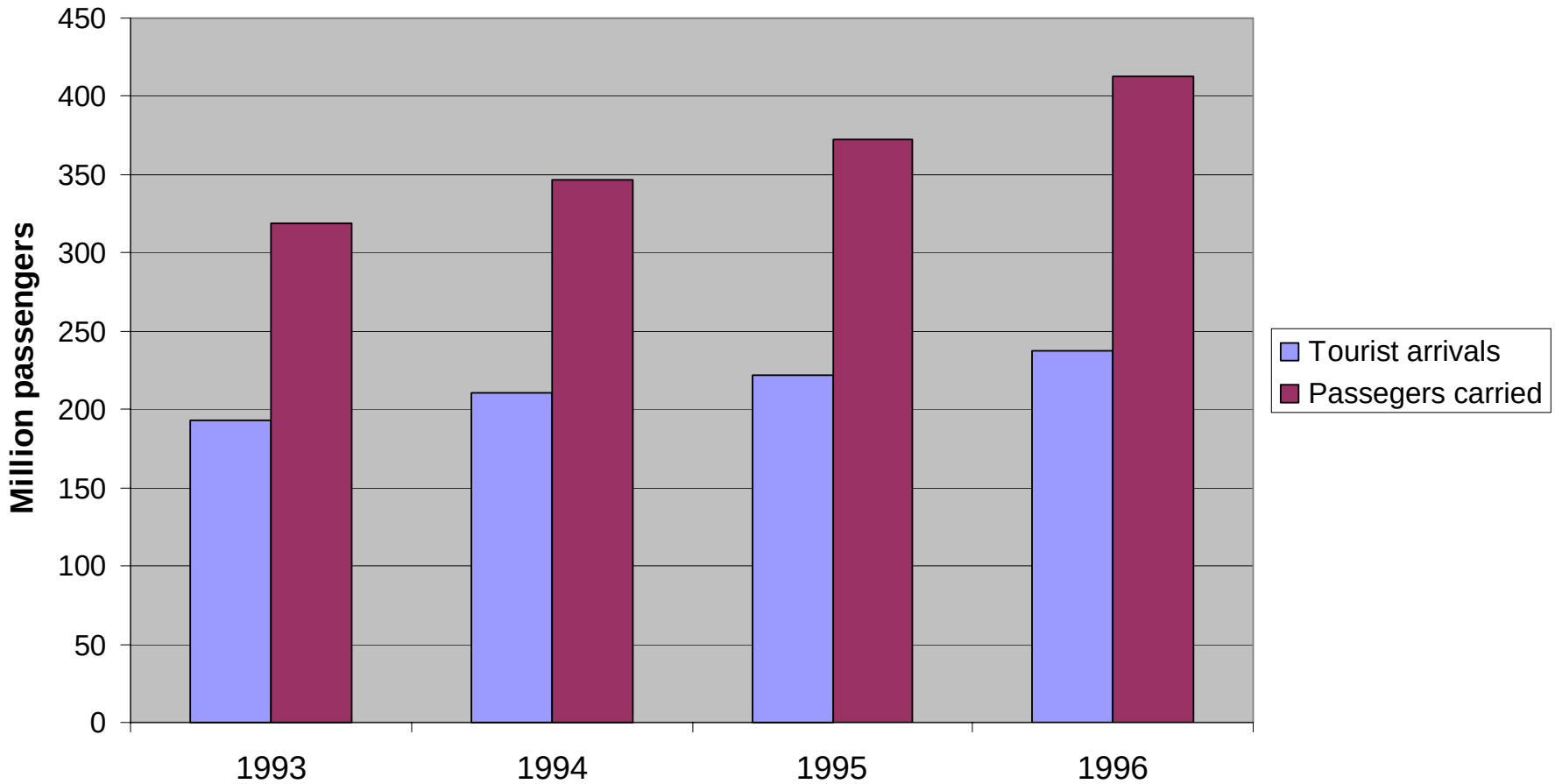
Source: World Bank

GNP and air passengers



Source: World Bank

World tourism and air transportation



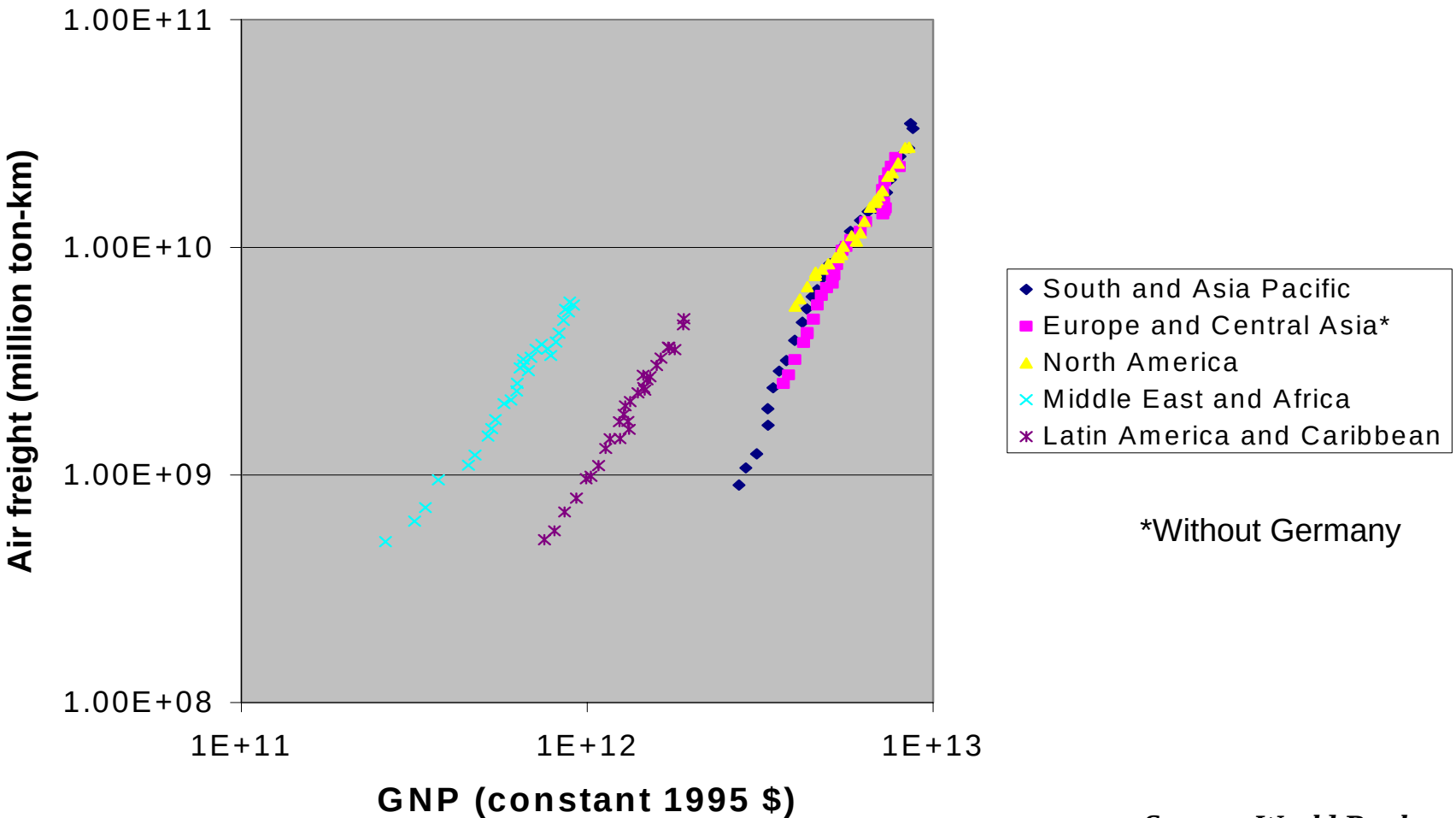
Source: World Tourism Organization

Keeping some perspective

	GNP 1996 (const 1995 Billion US$)	GNP per capita 1996 (const 1995 US$)	Population 1996 (millions)
Honduras	3.9	663	5.8
Namibia	3.5	2,225	1.6
Singapore	93.2	30,620	3.0
Turkey	183.9	2,989	61.5
Japan	5,455.5	43,380	125.8
United States	7,363.1	27,765	265.2
World	29,617.9	5,164	5,736.0

Source: World Bank

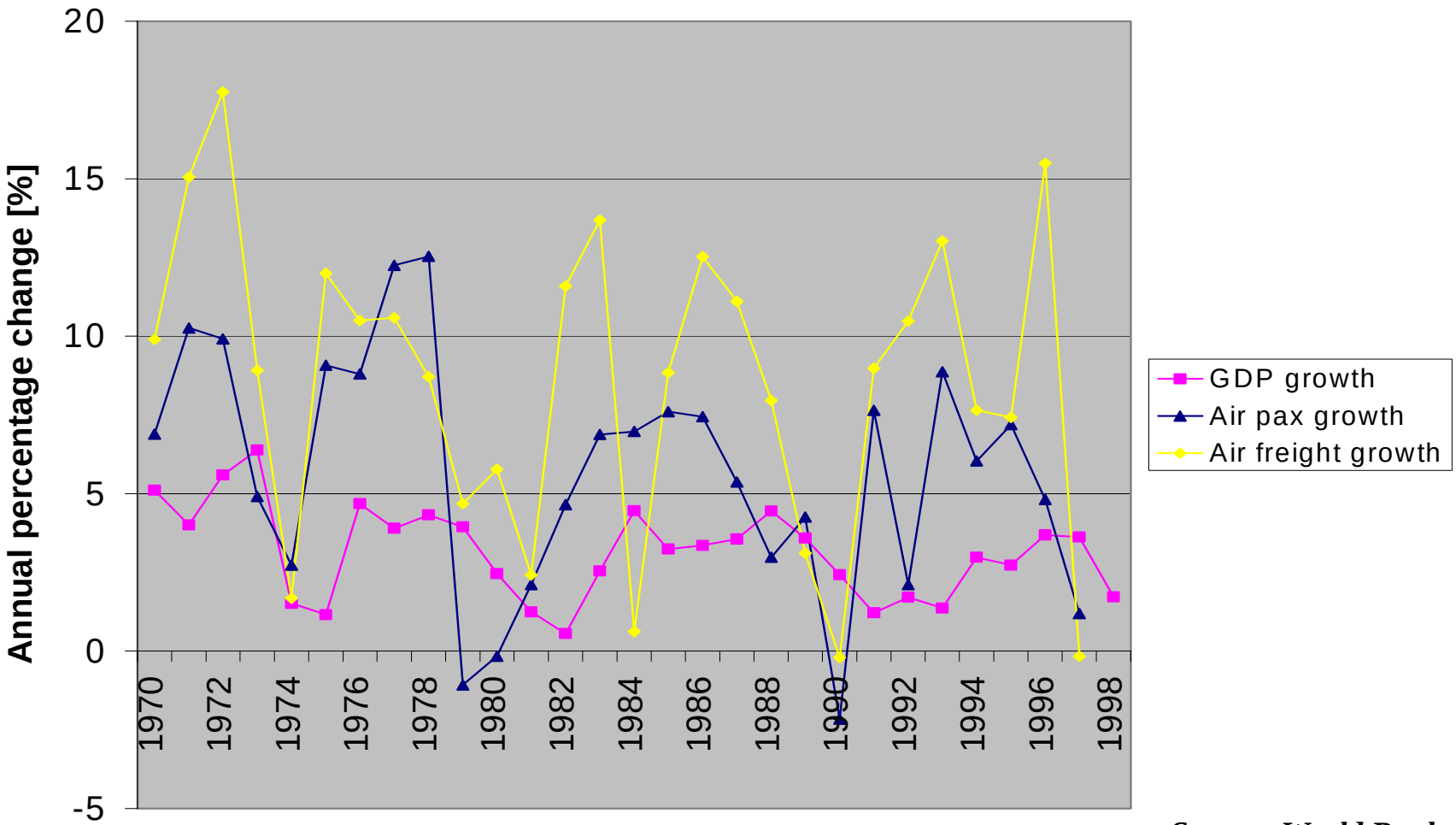
Air cargo and GNP



*Without Germany

Source: World Bank

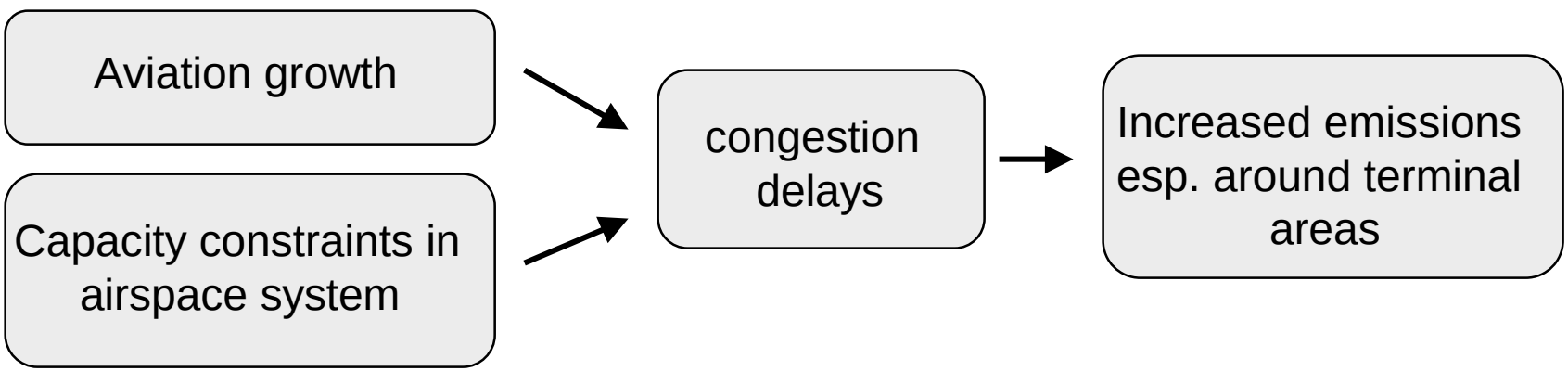
Air cargo and GDP growth



Source: World Bank

Aircraft emissions

- **Aviation is a significant source of emissions**
- **Aircraft global CO_2 anthropogenic emissions:**
  - 1992: 0.14 GtC/year (2% of world total)
  - 2050: 0.28 - 1.5 GtC/year (4% - 12% of world total)
- **Air transportation expected to grow approx. 5% per year for next 10-10-15 years**



Local impact: isolated communities

- **There exist examples of communities around the world whose whose development would be severely limited without air transportation:**
  - Alaska
  - Iquitos, Peru
  - Southwest Pacific Region, Costa Rica


SIMBOLOGIA
LIMITE DE ZONA DE ANALISIS
AEROPUERTOS EXISTENTES
CABECERAS DE DISTRITOS
RUTAS TERRESTRES ESQUEMATICAS
POBLADO DE MAS DE 1000 HABITANTES
POBLADO DE MAS DE 5000 HABITANTES
NICARAGUA
AREA CENTRAL
PANAMA
GRAFICO II.1
ZONAS DE ANALISIS
1. AMUBRI
2. CAÑAS
3. CARRILLO
4. C. QUESADA
5. COBANO
6. S. COLORADO
7. CHACARITA
8. LOS CHILES
9. GOLFITO
10. GUAPILES
11. GUATUSO
12. JACO
13. LIBERIA
14. LIMON
15. NICOYA
16. PALMAR
17. COTO 47
18. PUERTO JIMENEZ
19. QUEPOS
20. SAN ISIDRO
21. SAN VITO
22. SIXAOLA
23. TAMARINDO
24. UPALA
25. LA CRUZ
MINISTERIO DE OBRAS PUBLICAS
Y TRANSPORTES
DIVISION DE TRANSPORTES
ESTUDIO DE AEROPUERTOS LOCALES
ZONAS DE ANALISIS
BEL INGENIERIA S.A.
EDWARDS AND KELCEY
INTERNATIONAL INC.
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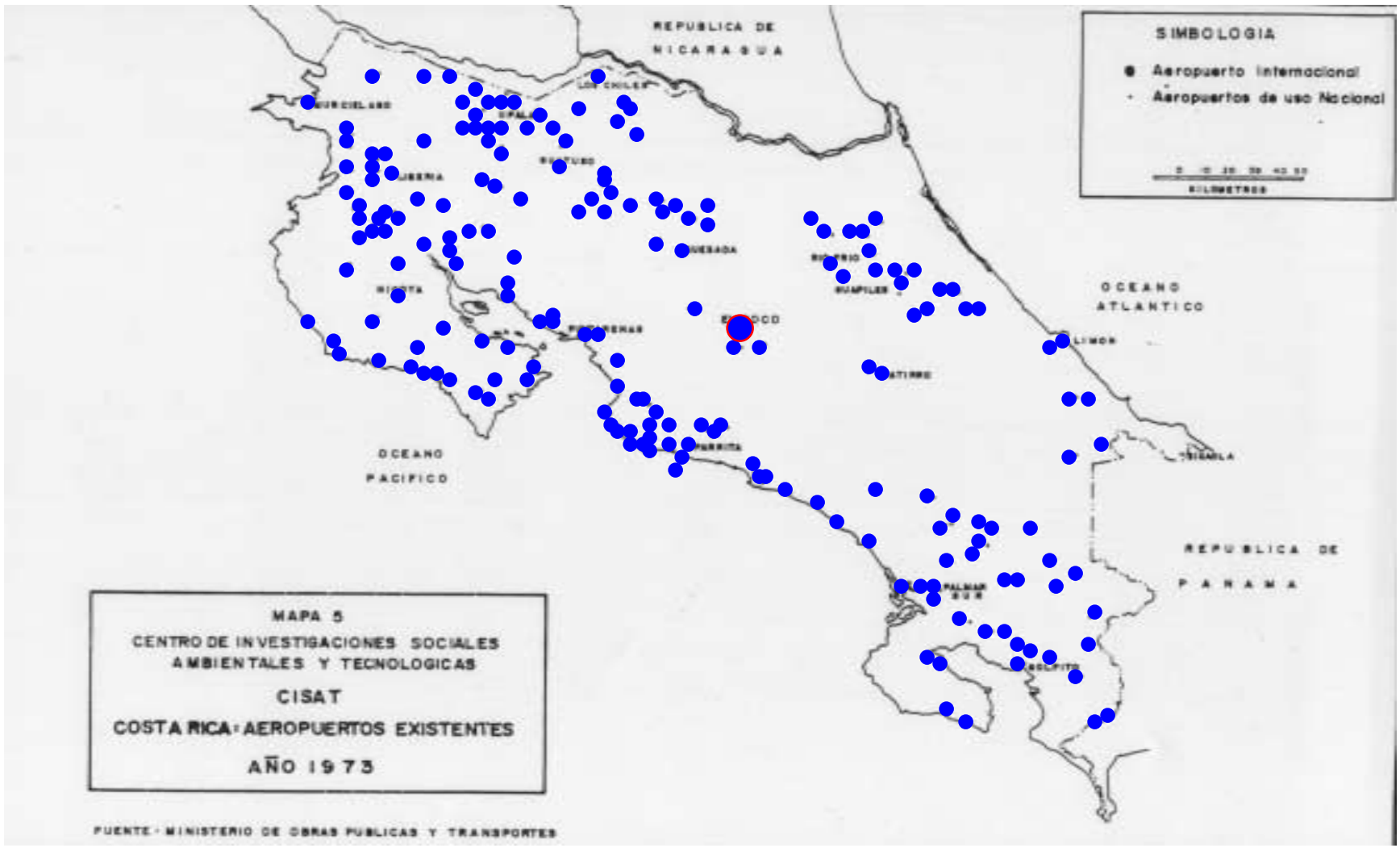
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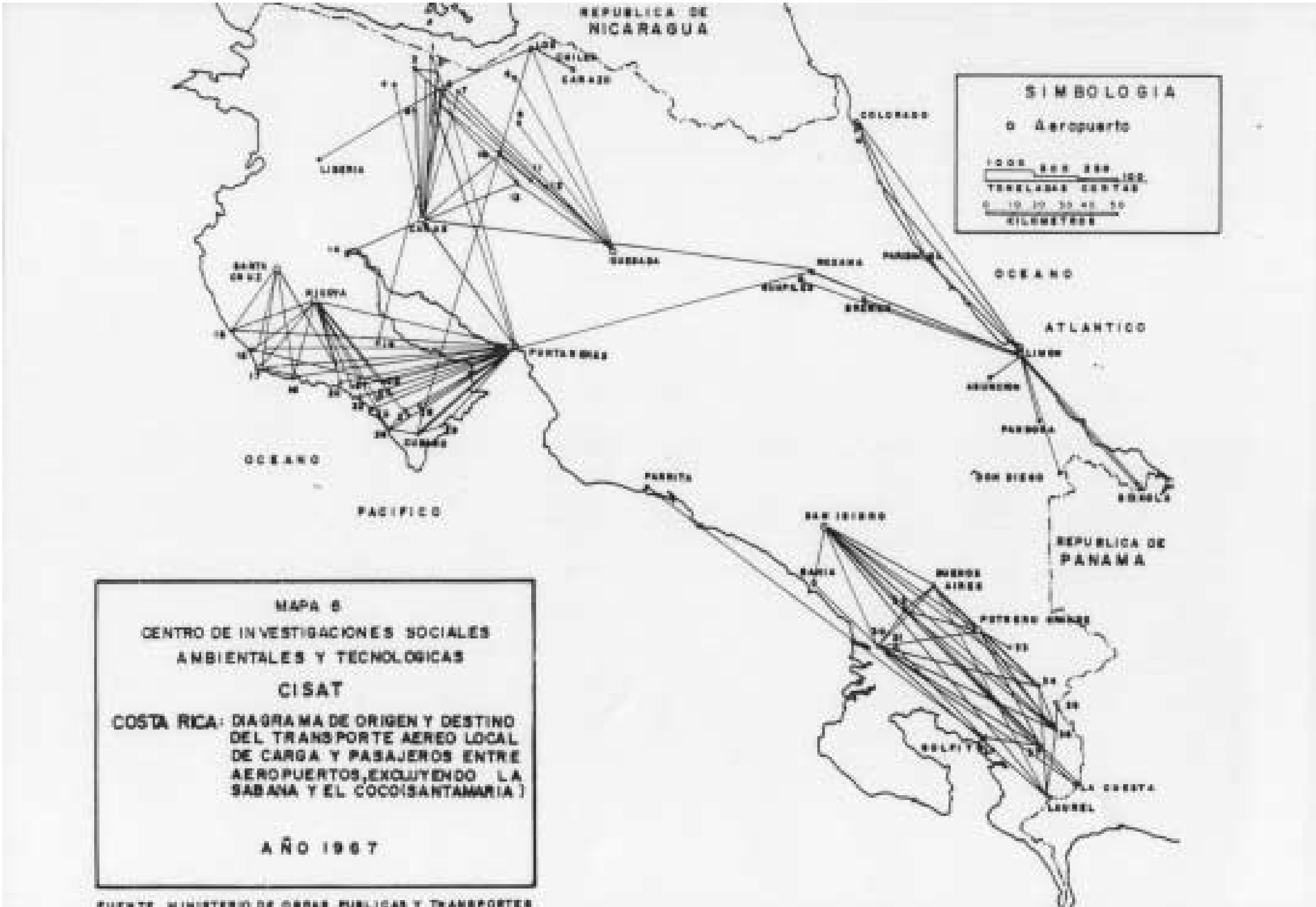
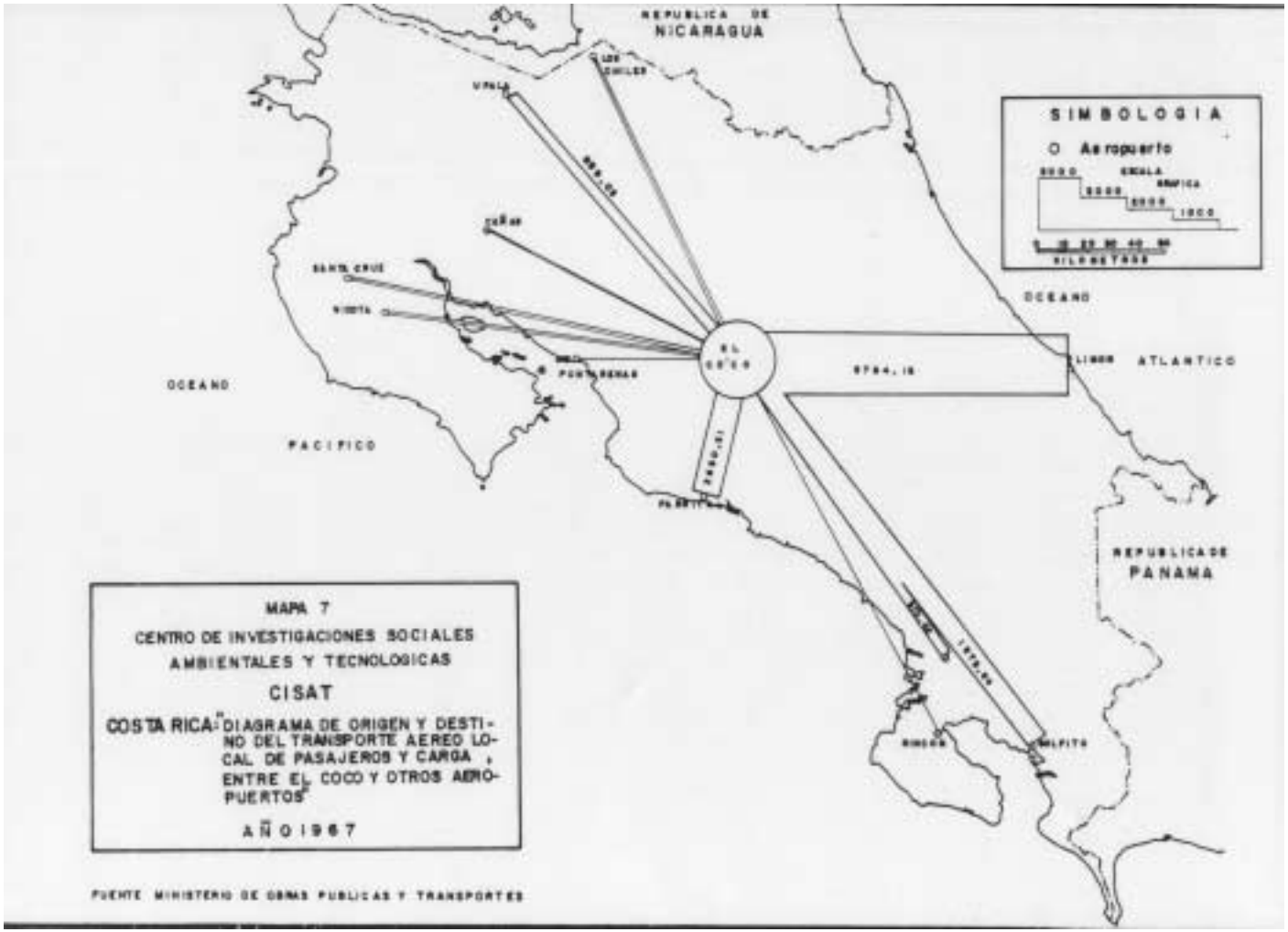
SIMBOLOGIA
Aeropuerto Internacional
Aeropuertos de uso Nacional
OCEANO
ATLANTICO
OCEANO
PACIFICO
REPUBLICA DE
PANAMA
MAPA 5
CENTRO DE INVESTIGACIONES SOCIALES
AMBIENTALES Y TECNOLOGICAS
CISAT
COSTA RICA: AEROPUERTOS EXISTENTES
AÑO 1973
FUENTE: MINISTERIO DE OBRAS PUBLICAS Y TRANSPORTES


REPUBLICA DE
NICARAGUA
SIMBOLOGIA
o Aeropuerto
TONELADAS CORTAS
KILOMETROS
LIBERIA
COLORADO
QUESADA
PUNTARENAS
LIMON
OCEANO
ATLANTICO
OCEANO
PACIFICO
PARRITA
SAN ISIDRO
BUENOS AIRES
REPUBLICA DE
PANAMA
GOLFITO
LA CUESTA
LAUREL
MAPA 6
CENTRO DE INVESTIGACIONES SOCIALES
AMBIENTALES Y TECNOLOGICAS
CISAT
COSTA RICA: DIAGRAMA DE ORIGEN Y DESTINO DEL TRANSPORTE AEREO LOCAL DE CARGA Y PASAJEROS ENTRE AEROPUERTOS,EXCLUYENDO LA SABANA Y EL COCO(SANTAMARIA)
AÑO 1967
FUENTE MINISTERIO DE OBRAS PUBLICAS Y TRANSPORTES


REPUBLICA DE NICARAGUA
SIMBOLOGIA
Aeropuerto
OCEANO
PACIFICO
ATLANTICO
REPUBLICA DE PANAMA
MAPA 7
CENTRO DE INVESTIGACIONES SOCIALES AMBIENTALES Y TECNOLOGICAS
CISAT
COSTA RICA: DIAGRAMA DE ORIGEN Y DESTINO DEL TRANSPORTE AEREO LOCAL DE PASAJEROS Y CARGA, ENTRE EL COCO Y OTROS AEROPUERTOS
AÑO 1967
FUENTE MINISTERIO DE OBRAS PUBLICAS Y TRANSPORTES